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JPRS Report

Nuclear Developments

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NUCLEAR DEVELOPMENTS

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URANIUM REPORTED SENT TO U.S. VIA UK, USSR

51000005 Umtata Capital Radio in English 1400 GMT 11 Oct 87

[Text] It is claimed Britain and the Soviet Union are laundering uranium from South Africa and Namibia, according to confidential documents obtained by Britain's *Observer* newspaper. The uranium is then being sent to the United States. Karen Pickess-Gill reports from London:

[Pickess-Gill] [Words indistinct] sanctions against South Africa do not prohibit imports of uranium, providing they have been processed elsewhere. This is the loophole the *Observer* claims Moscow and Britain are exploiting. The paper says one of the first of these laundered shipments, 20 tons worth, will arrive in America this week after being converted into hexachloride in Britain and enriched in the Soviet Union. In the states, it will reportedly be manufactured into fuel rods. British Nuclear Fuels have refused to confirm that it was involved in converting uranium, citing commercial confidentiality, though a spokesman did point out there were no British restrictions, on processing uranium from South Africa and Namibia for foreign customers.

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BOTHA WILLING TO SIGN NON-PROLIFERATION PACT

51000001b Johannesburg SAPA in English 1746 GMT 21 Sep 87

[Text] Cape Town Sept 21 SAPA—The state president, Mr P.W. Botha, today confirmed that South Africa hopes to sign the Nuclear Non-Proliferation Treaty.

In a statement in Cape Town in response to press inquiries he said South Africa was prepared to commence negotiations towards signing the treaty, but that such negotiations would depend on the outcome of the 31st General Conference of the International Atomic Energy Agency [IAEA] due to start in Vienna tomorrow.

In his statement Mr Botha said that South Africa had been negotiating with individual countries and the IAEA for some years regarding conditions for guarantees on South African installations.

South Africa's view had been put to the respective governments in the past week. They had been told:

"The RSA is prepared to commence negotiations with each of the nuclear weapons states on the possibility of signing a non-proliferation treaty.

"At the same time RSA will consider including in these negotiations safeguards on its installations subject to the NPT [Non-Proliferation Treaty] conditions.

"The nature of these negotiations will depend on the outcome of the 31st General Conference of the IAEA to be held in Vienna as from September 22," Mr Botha said.

"RSA hopes that it will soon be able to sign the NPT and had decided to open discussion with others to this end. Any safeguard agreement which might subsequently be negotiated with the IAEA would naturally be along the same lines as, and in conformity with, agreements with other NPT signatories."

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NUCLEAR DETONATION REPORTED NEAR MOZAMBIQUE

51000003b Johannesburg THE STAR in English 8 Oct 87 p 13

[Text] Harare—Zimbabwe's national news agency, ZIANA, filed a story on Tuesday quoting the *Press Trust of India* [PTI] agency as saying that South Africa was believed to have detonated a nuclear bomb near its border with Mozambique on September 30.

The report said a seismic array station at Gauribadanur in the southern Indian state of Karnataka recorded the event last Wednesday.

The *Press Trust of India* quoted sources at the Bhabha Research Centre who said the explosion had the characterics of a nuclear explosion.

It said the explosion was traced to the border between Mozambique and South Africa.

A spokesman for South Africa's Atomic Energy Corporation said the corporation did not comment "on such highly speculative reports."

The Indian news agency said the strength of the explosion was estimated at 25 kilotons and the Gauribadanur Station could detect the location of a nuclear blast to an accuracy of 90km.

The report said the station was awaiting confirmation from stations in Australia and the U.S.

It said the blast generated signals with the double hump typical of nuclear explosions.

"The signals recorded compared very favourably with events of a similar nature recorded by stations in the USSR, the U.S. and from French stations in the South Pacific, according to sources," said the PTI report.

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RSA NUCLEAR PROGRAM 'DIRECT THREAT'

51000001c Johannesburg SAPA in English 2254 GMT 22 Sep 87

[Text] Harare Sept 22 SAPA—Zimbabwe told the International Atomic Energy Agency today that it faced direct threats from civil and military nuclear installations in South Africa, ZIANA reports.

The agency's 31st regular session in Vienna, the Austrian capital, was informed by the minister of energy, water resources and development, Mr Kumbirai Kangai, that Zimbabwe's "profound disagreement with the apartheid policy of South Africa automatically makes us a target for unprovoked attacks by this racist and unfriendly neighbour." His speech was released in Harare by the Zimbabwe Government.

"Zimbabwe faces direct threats from the civil and military nuclear installations in South Africa," he said.

Mr Kangai said Zimbabwe was "extremely concerned" that South Africa had failed to place its nuclear facilities under the agency's safeguards.

He said that although the South African Government had signed and ratified agency conventions, "We note the declaration attached to the instrument of ratification which clearly indicates that the Botha regime is no nearer to recognising the authority of the United Nations Council for Namibia.

"We can only see sinister motives behind this attitude and cannot see why South Africa should continue to be a member of the agency while displaying such blatant disregard for the resolutions by both the United Nations General Assembly and the agency's general conference.

"This is not only in matters relating to nuclear weapons, but also the illegal occupation of Namibia, the invasion and occupation of parts of Angola, the denial of human rights to the majority of her population and sponsorship of subversive elements, such as MNR bandits (in Mozambique), aimed at destabilising neighbouring states," said the minister.

Mr Kangai said that radiation protection was a high-priority area for Zimbabwe and a manpower training programme was underway with the agency's assistance.

He said that, although a relative newcomer to the agency, he was pleased that the benefits of Zimbabwe's membership were already bearing fruit. Though Zimbabwe had legislation to cover the importation, handling and use of radio isotopes, loopholes had already come to light, especially regarding disposal.

"Improvements are being effected and we expect the agency's assistance in this regard," said Cde Kangai.

He said that Zimbabwe, as chairman of the Nonaligned Movement of nations, was strongly against the continuation of the arms race by the super powers, and he urged the Soviet Union and the United States to "earnestly commit themselves to a spirit of give-and-take in their arms reduction talks.

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COMMENTARY SEES REASONS FOR RSA NUCLEAR TEST

5100000Se Maputo Domestic Service in Portuguese 1930 GMT 7 Oct 79

[Commentary by Radio Mozambique journalist Leo Mthembu]

[Excerpts] In September 1979 a U.S. satellite monitored a double light signal, a clear indication of a nuclear explosion, in the southern Atlantic Ocean, off the South African coast. Three days later, South African Prime Minister P.W. Botha told the world, quote, we have the military weapons and they don't know it, unquote. It was not surprising, therefore, that in December 1979 the South Africans were prevented from attending an International Atomic Energy Agency conference in New Delhi. [passage omitted]

There is some indication that South Africa could have carried out a new, though low-yield, nuclear test close to the border of one of its neighbors. Although no U.S. satellite seems to have monitored any signal this time, a nuclear research center in India disclosed that a nuclear test had taken place on the Mozambican border on Wednesday last week. A source with the Bhabha nuclear research center told the *Press Trust of India* that a 25 kiloton explosion had been detected in an area close to the Mozambican border. The explosion, which is typical of a nuclear blast, was recorded by the Gauribadanur seismic station in the Indian state of Karnataka.

It is interesting to note that the incident took place at a time when Pretoria has been threatening its neighbors militarily, despite all efforts that are being made to solve regional conflicts peacefully. Why would South Africa have chosen its border with Mozambique to carry a nuclear explosion? This is a question demanding an immediate reply.

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NUCLEAR SAFETY COUNCIL ISSUES ANNUAL REPORT

S1000001a Johannesburg SAPA in English 1831 GMT 21 Sep 87

[Text] Parliament Sept 21 SAPA—The Council for Nuclear Energy and Power—met only eight times last year, according to the council's annual report for 1986, tabled today.

Seeing that the Koeberg Nuclear power station had come into full operation during 1985, it had not been necessary for the council to meet as frequently as in the past, the report said.

It said that over the past year the council had reviewed technical data and information referred to it by the licensing branch of the Atomic Energy Commission concerning engineering modifications to the Koeberg plant, the introduction of improved handling procedures for control-rod assemblies and transport of nuclear-hazard material.

At the request of the government, the council had reduced its budget to R175 000 from R179 000 in the previous financial year.

The future promised to be stimulating in respect of ongoing developments in the application of sound safety concepts and practices at Koeberg, at other nuclear facilities and in the mining industry, the report said.

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URANIUM ENRICHMENT PLANT AT VALINDABA TO START COMMERCIAL PRODUCTION

51000002 Johannesburg ENERGY (Supplement to Financial Mail) in English
24 Jul 87 pp 16-17

[Text] **The Atomic Energy Corporation's** (AEC) uranium enrichment plant at Valindaba is expected to come into commercial production by the end of the year, thus ending Eskom's dependence on foreign enrichment facilities.

The facility has a design capacity of 300 t of separative work a year — enough to provide 75 t of 3,25% enriched uranium — 50% more than the requirement of Eskom's Koeberg nuclear power station.

If it performs according to design, it will supply enough enriched uranium for three reactors of the Koeberg type. "We expect the actual capacity to be a little more than the design capacity," says Dr Wynand de Villiers, chief executive officer of the AEC.

At the current cost on world markets of more than US$100 a separative work unit (SWU), the plant will save R20m a year in foreign exchange, according to De Villiers. (An SWU is a measure of the amount of energy used to perform the enrichment process, not of the mass of the enriched uranium supplied.)

"Because of the size of the plant it will not be economically competitive," says De Villiers. "We cannot produce at going world prices. A commercial-sized plant would be in the range of 5 000 t-10 000 t of SWUs. We are less than a tenth of that."

When the plant was first announced, officials hoped to find export markets for production surplus to local requirements. Now, however, De Villiers concedes this is "fairly unlikely" — not only because of politics, but also because there is a world surplus of enrichment capacity.

Price has become a constraining factor. "I am sure the prices quoted overseas for enriched uranium are below cost — just to keep their plants running," De Villiers says. "A few years ago the US was quoting $135 per SWU. They are now in the market at $77-$80. That is probably not profitable for them.

"We will only consider expanding or providing extra capacity when Eskom decides to build more nuclear power stations."

De Villiers believes the manufacture of fuel elements should also be undertaken in the future. "Although a plant to manufacture fuel elements will be cheaper than an enrichment plant, it nevertheless only becomes viable when you have 8 000 MW to 10 000 MW of nuclear generation capacity installed." (Koeberg's two reactors have a combined installed rating of under 2 000 MW).

The market for natural uranium is also over-supplied. An indicator, though an inexact one, is the spot price for natural uranium, which has dropped from $42-$44 in 1979-1980, to $17 at present.

Less than 10% of uranium is sold in the spot market, and information about long-term contract prices (usually in the region of eight to 10-year contracts) is highly confidential. Much of the trade on the spot market comprises uranium surplus to original contract requirements.

"It is a cut-throat business, and everybody is sharpening his pencils," says De Villiers.

De Villiers points out that although the anti-nuclear movement has had some impact, the depressed state of the uranium market owes as much to the slowdown of growth in the electricity generation industry.

"But by 1992-1993 the demand for uranium is likely again to outstrip production, and by that time we expect the price to rise."

"There has been slow growth in the Western economies, and many of the power stations that were on the cards were delayed or

halted. The world cannot afford to build more power stations at the moment. In the US, construction of a number of coal stations was stopped."

Enrichment is a process which lifts the content of the fissionable isotope (U235) in natural uranium from 0,71% to 3%-3,5%, which is a level sufficient to operate a nuclear power station.

The enrichment phase of nuclear fuel production is the one that has presented most problems in keeping Koeberg going. Back in 1974, when Koeberg was still in the planning stage, Eskom signed a contract with the American enrichment plant at Oak Ridge for the supply of enriched uranium which would be fabricated into fuel rods in France (the fuel element fabrication was part of the contract with the French constructors of Koeberg.)

President Carter

However, US President Jimmy Carter subsequently placed an embargo on the supply of enriched uranium to countries that were not signatories of the International Non-Proliferation Treaty — and that included SA.

Under the American Nuclear Non-Proliferation Act, supply was also restricted to nations that adopted "full scope" safeguards, including international inspection.

The fact that Koeberg is up and running testifies to Eskom's success in obtaining enrichment facilities. But from whom, remains classified information. Clearly, though, supply can only be assured from a local facility.

Since SA is one of the world's largest producers of uranium, the procurement of natural uranium presents no problems. SA's expected annual requirements of uranium until 1995 — mostly for Koeberg — will absorb only about 6% of the country's output, according to Peter Spencer, Eskom's nuclear manager.

Spencer was the project manager for Koeberg from its inception; though now that the unit has been handed over into commercial production, his role is primarily engineering support and problem solving, and fuel procurement and disposal.

"We have a front-end activity which is to handle the entire job of procuring uranium and getting it converted into the form required for enrichment and then manufacture into fuel rods," he says. "At the power station, their concern is the effective use of that fuel within the core of the reactor.

"When the fuel has performed its job, you have to take custody of it for a long time. Then we come in again with responsibility for storage and disposal."

There are just over 150 fuel elements in the reactor core, each containing half a ton of enriched uranium, and a third of them are replaced annually.

The first Koeberg unit, which has been in operation now for three years, has already had one outage and refuelling; and the second, which came on stream a year after the first, was refuelled this year.

"Between the two units, refuelling will now be an almost annual event," says Spencer. "However, there are a number of changes in this regard. Internationally, there is a tendency to move towards a longer refuelling cycle. Some countries have stretched it to almost 18 months.

"We are working on a 14-15 month cycle at present. What happens is that as you exhaust your fuel, the power output declines from 100% to say 50%, but that gives you an extra two to three months' running capability from the core.

"It's a question of economics — balancing the cost of refuelling early against the loss of output. We want to stretch out our enrichment supplies as much as we can, until our own supplies from Valindaba become available." Total cost of refuelling a unit the size of Koeberg's two 920 MW reactors is of the order of R75m.

Fortunately, with spare capacity in the Eskom system at present, it is not vital that Koeberg runs at maximum output.

The fuel removed from the reactor is stored under water in the spent fuel pool at the power station site, where it will remain for four to 12 years. After that, it is moved to the long-term storage facility at Vaalputs, in Bushmanland.

Enrichment doesn't come cheap. A normal buyer on world markets would pay about $120/kg of separative work. For political reasons, however, Eskom has to pay a premium to get its separative work done — a factor which enhances the relative economics of the Valindaba plant. Moreover, its separative work was purchased at the beginning of the Eighties, when prices were higher than they are now.

"Separative work has been selling in the US for as low as $80-$90 per SWU," says Spencer. "Certainly, we can't get access to that sort of market."

At $120 an SWU, says Spencer, nuclear power is competitive with other energy sources in most Western countries. "This is not universally true, however. In a country with very cheap coal, like SA, and some parts of the US, nuclear power is not competitive. Nor is it competitive against hydroelectricity.

"But in France, West Germany, Britain, other parts of Western Europe, and South America, nuclear power is highly competitive and has secured a considerable foothold."

The natural uranium market is subject to similar price variations. While most customers are paying $40-$60/lb for yellowcake on long-term supply contracts, it is possible by shopping around to pick it up in the US for as low as $20.

"Uranium prices were driven up at a time when the ordering rate for nuclear power stations was brisk," says Spencer, "but in the Seventies and Eighties the ordering rate has fallen off dramatically. This has brought the price of uranium down."

The price is also linked to those of alternative energy sources, particularly oil. The slump in oil prices forced uranium suppliers to reduce their prices in order to remain competitive.

"Uranium prices are likely to remain low until the end of the century," says Spencer. "The world view of utilities is that the prices are acceptably low and will stay that way."

The nuclear development programme around the world has been adversely affected by increased concern over safety in the wake of the Chernobyl disaster, too, although opponents of nuclear energy tend to overstate their case.

"Slow growth of demand for energy in the West has also played a part," says Spencer. "The French, who have not been overly deterred by safety fears, have concentrated as much on replacement as expansion."

Although in the long term there is an inevitability about expansion of the nuclear programme here, Eskom right now does not have any commitment in its forward planning (covering the next 10-15 years) for further nuclear units.

The view coming out of joint studies with the Atomic Energy Commission is that nuclear energy will remain more expensive than coal for some considerable time. But by 2030-2040 Eskom will have used up virtually all the coal available for power generation, and it will have to switch the emphasis to nuclear energy.

Solar energy, biomass energy, and other exotic forms may have a role to play, but they do not offer the hope of providing energy on the scale that nuclear energy can.

Obviously, the switch cannot be made overnight, and within the next few years crucial decisions will have to be made about how a locally-produced nuclear power station programme can be developed and paid for. ■

/13046

CANBERRA SEEKS EXPLANATION ON NUCLEAR LIST

Auckland THE NEW ZEALAND HERALD in English 4 Sep 87 p 7

[Text] Australia has asked the United States to clarify reports that its Department of Commerce has circulated a list indicating Australia has five sites where nuclear weapons can be manufactured.

A spokesman for the Department of Foreign Affairs said yesterday that Lucas Heights, near Sydney, was the only plant where quantities of sensitive nuclear material were stored.

"We are asking advice from the Americans as to what the list, if it exists, refers to," the spokesman said.

On List

But, he said, as Australia was a signatory to the Nuclear Non-proliferation Treaty and the South Pacific Nuclear-free Zone Treaty, it was bound not to produce any nuclear explosive devices.

The Foreign Affairs move follows a report in the British *Guardian* newspaper that Australia and 13 other countries were named in a list of potential nuclear weapons manufacturers that was circulated by the United States to thousands of computer salesmen.

The United States is concerned that its advanced technology should not be sold for the manufacture of weapons, even by friendly powers.

Meanwhile, the deputy head of the Strategic and Defence Studies Centre at the Australian National University, Dr Ross Babbage, said the circulation of the list was a "non-story."

"I am astonished there has been such a reaction to it as everyone has known since the 1950s that Australia has most of the technology to produce nuclear weapons if it wanted to," he said.

"We have the skills, most of the equipment and most of the material needed to produce nuclear weapons, but the fact is we are just not going to.

"Australia has been a very strong supporter of the nuclear non-proliferation treaty and has got other countries in the region to sign it."

Dr Babbage said the listing of five installations in Australia could refer to conventional defence factories as well as the country's only nuclear reactor plant at Lucas Heights.

Plant Guide

In the *Guardian* report the list is described as a comprehensive guide to every potential nuclear weapons manufacturing plant in the West.

The list has been issued by the United States Department of Commerce as a guide for computer salesmen to prevent them allowing United States technology to be used in the manufacture of nuclear weapons even by friendly powers.

The other countries listed were Belgium (12 installations), Canada (13), Denmark (one), West Germany (37), France (29), Greece (two), Italy (27), Japan (31), Netherlands (nine), Norway (three), Portugal (two), Turkey, (four) and the United Kingdom (25).

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GUANGDONG SITE FOR SECOND NUCLEAR POWER PLANT

51500033 Hong Kong HONGKONG STANDARD in English 21 Sep 87 p 1

[Article by Andy Ho and Chan Wai-fong]

[Text]

CHINA is planning to build another nuclear power station in Guangdong.

The Chinese authorities have yet to identify a site for the plant but a high-ranking official said it would not be as close to Hongkong as the controversial Daya Bay installation.

The second Guangdong plant will be one of seven new nuclear power stations in China's ambitious civilian nuclear programme covering the next 30 years.

The head of the Scientific and Technical Information Institute of the Ministry of Water Resources and Electric Power, Mr Liu Chun-sheng, said the development of nuclear plants along the Chinese coast was "imperative".

He told *The Standard* during a recent visit that the new nuclear projects would be on a joint venture basis, like the Daya Bay scheme.

So far neither the China Light and Power Company nor the Hongkong Electric Company has been approached to join the feasibility study for the project.

China Light, which took part in the Daya Bay feasibility study, now holds a 25 percent stake in the $28.8 billion joint venture with China.

Also in the pipeline are 17 pumped water storage power stations with a combined output of 12,500 megawatts.

These stations will maximise the nuclear plants' electricity output at off-peak hours.

Mr Liu said the new plants would be equipped mainly with 900 to 1,200 megawatt reactors, as most of the plants' key components would have to be imported.

These types of reactors were the most commonly used in Japan, Europe and the United States.

Sites in southern Jiangsu province and the western coast of the Bohai Bay at Jinxin, Liaoning province, have been chosen.

The other five will be built in the coastal provinces of Fujian and Shandong and the inland provinces of Hunan and Jiangxi.

China has been preparing the sites for several years, but shelved construction plans about three years ago because of a policy to reduce foreign exchange expenditure.

Mr Liu said the situation had now improved and China would have the necessary foreign reserves to go ahead with the programme.

"Nuclear energy is not a priority on China's agenda for energy development," he said.

"But due to problems in long distance coal transport, nuclear power is much needed for the coastal areas."

More flexible measures, such as tax concessions, had been introduced to raise capital for the expensive nuclear programmes.

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HELP 'CLOSE BY' IN CASE OF NUCLEAR ACCIDENT IN PRC

51500031 Hong Kong HONGKONG STANDARD in English 7 Sep 87 p 3

[Article by Andy Ho]

[Text]

VICTIMS of a nuclear mishap in China who are in need of urgent bone marrow transplants can, if necessary, be flown out of the country for treatment through an international medical network.

Dr Robert Gale, who chairs the International Bone Marrow Transplant Registry's advisory committee, told *The Standard* that experts at their centres would be easily accessible in case of a major nuclear accident anywhere on earth.

China now has three transplant centres which are affiliated to the registry which is based in Milwaukee in the United States, Dr Gale said.

The centres, in Beijing, Shanghai and Nanzhou, are part of the network's 130 transplant units in 32 countries.

"If a large number of people are in need of bone marrow transplants during a nuclear emergency we are ready to move them around the world. It is not very far from China to Japan, for example, and the United States is only 24 hours away," Dr Gale said.

He is optimistic that even a serious accident at Daya Bay will not result in any Hongkong resident requiring immediate hospital care.

China's two nuclear power stations — one at Qinshan near Shanghai and the other at Daya Bay — are to come online in 1989 and 1992, respectively.

Dr Gale coordinated the bone marrow transplant operations in Moscow for the victims of the Chernobyl disaster.

He paid a short visit to Hongkong last week to share with the local medical community his experiences in helping victims of nuclear accidents.

Dr Gale said that, unlike heart attack victims, bone marrow transplant patients had "at least a couple of days to move."

"If a person's bone marrow is irreversably destroyed by radiation, engraftment of such new blood-forming tissue is his only alternative to certain death.

"One of the advantages of our registry is that we have the service ready all around the world. But obviously we will work on a regional basis," he said.

The closest bone marrow centres outside China are in Japan and South Korea. A similar unit here at Queen Mary Hospital will become operational by January 1989.

The local centre's advanced facilities, though installed primarily for leukemia patents, can render valuable service to nuclear accident victims exposed to excessive radioactivity.

It will eventually be registered with the international registry.

The registry also provides a large pool of volunteer bone marrow donors.

It is also vital that the transplanted bone marrow matches the recipient's to avoid rejection and other fatal complications.

The operation itself is a relatively simple process: the marrow is given to the recipient through a transfusion.

The marrow will eventually be deposited in the hollow of the bone as the blood circulates through it.

Dr Gale said that a more difficult task would be to assess the risks and benefits of performing a transplant, which may be counter-productive if the victim is suffering from too high or too low a radiation dose.

In the Chernobyl case, 19 out of the approximately 500 victims who were admitted to hospital immediately after the disaster, underwent bone marrow transplants, Dr Gale said.

They were flown to Moscow for intensive care. However, 13 of the recipients died over the next three months, he said.

Dr Gale said that the Chernobyl disaster was the first time that physicians had to deal with so many transplants at one time.

At one stage, marrow for two victims were sought in the United States but the request was later dropped when one patient died. Doctors later decided to try to use marrow from a relative for the second patient.

Marrow for a potential transplant is matched through analysis to determine if the donor and recipient have similar genetic makeups.

Under the best conditions, the estimated success rate for tranplants is 80 percent.

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REPORTAGE ON DAYA BAY SAFETY CONCERNS

Briefing by IAEA Director

51500032 Hong Kong SOUTH CHINA MORNING POST in English 11 Sep 87 p 2

[Article by Bernard Fong]

[Text]

AN International Atomic Energy Agency (IAEA) official has ended a visit to China impressed by the nuclear technology he had seen and apparently confident about the safety aspects of the Daya Bay nuclear plant.

IAEA director-general Mr Hans Blix briefed the Office of the Members of the Executive and Legislative Councils (Omelco) special committee on the Daya Bay plant on his recent trip to China, where he examined a Chinese-built reactor in Chinshan, near Shanghai.

Mr Blix, who was invited to China, said he was generally impressed with the calibre of the engineers and the level of nuclear technology in the country.

Although he did not visit the Daya Bay site, which is 50 km from Hongkong, he said the technology of the plant itself had a proven record of safety and reliability.

"The Daya Bay plant is one which is well known in technology . . we know very well what type of reactor it is," he said.

Mr Blix was on his way back to Vienna after going to China to check on the country's first indigenous nuclear power plant.

The Chinshan reactor should be operational before the joint venture, French-built Daya Bay plant goes on stream in the early 1990s.

He said China had asked the IAEA to send a full mission to Chinshan to discuss "operational safety" at the power station, which would be a showcase of Chinese nuclear technology on its completion in about two years.

"We will do so in due course, as we have done in Mexico, Korea and many other countries," Mr Blix said, referring to China's request for continuing co-operation with the IAEA.

Mr Blix said he had seen the safety measures adopted at the Chinshan plant, adding, "They (the Chinese) are learning from all the experience of the nuclear industry in other parts of the world (including) . . . the Three Mile Island and Chernobyl accidents."

In April, the Chinese Ministry of Nuclear Industry, the Ministry of Foreign Affairs, the State Science and Technology Commission and other departments evaluated and subsequently agreed to an IAEA draft on nuclear safeguards.

Mr Blix's trip was another step towards having Chinese nuclear power stations come under international scrutiny.

Deputy Minister of Nuclear Industry Mr Zhou Ping, whom Mr Blix met on his trip, said China was prepared to allow foreign experts to monitor the Daya Bay station's twin reactors, the IAEA director-general said.

The Deputy Director of the National Nuclear Safety Administration, Mr Shi Guangchang, said in April that China had been progressive in allowing IAEA to monitor its nuclear power plants when its nuclear power plant technology was still in its infancy.

China is known to have begun negotiating with IAEA on opening its plants for inspection more than a year ago, as the anti-Daya Bay movement in Hongkong picked up momentum in the wake of the Chernobyl accident in the Ukraine.

Daya Bay Model for PRC

Hong Kong SOUTH CHINA MORNING POST in English 12 Sep 87 p 2

[Text]

THE Daya Bay nuclear project would be a key consideration for the Chinese in making plans for the long-term development of power plants in dozens of cities, a Beijing official said yesterday.

The costs and merits of the $28.8 million joint venture at Hongkong's border would provide helpful guidelines when policy-makers decided between coal-fuelled electricity and the use of nuclear energy, an official of Beijing's Nuclear Ministry told the *South China Morning Post*.

The Daya Bay plant, being built 50 km from Hongkong, is China's second experiment with nuclear development. Its first – a pressurised reactors plant at Qinshan – will be in operation in 1990.

The official, who refused to be named, said the experience of the two projects would help determine China's future approach to power generation.

Commenting on official remarks on China's stated commitment to nuclear energy, the official said recent studies shed a favourable light on nuclear development in various parts of the country.

A senior nuclear engineer said nuclear energy was to be China's main source of power by the middle of next century.

"If the plan goes well, nuclear power will provide more than 50 per cent of China's total electricity generation by the year 2050," Mr Peng Shilu, chairman of the Science and Technology Commission, told a conference of nuclear experts in Beijing on Thursday.

Mr Peng, a chief engineer in the Nuclear Ministry, disclosed that China was expecting to invest US$2.1 billion (about HK$16.38 billion) to build six nuclear plants in the next decade, according to the *China Daily* newspaper.

The ministry is studying the feasibility of constructing a nuclear plant in the northern province of Heilongjing, he reportedly said.

Mr Peng's remarks surprised Western observers who recalled official statements that emphasised China's reliance on coal and hydropower sources over nuclear power.

Prime Minister Zhao Zhiyang had also stressed the development of hydraulic and thermal power against nuclear plants.

Earthquake Near Site

Hong Kong HONGKONG STANDARD in English 16 Sep 87 p 1

[Article by Andy Ho]

[Text]

CIVIL engineering work on the Daya Bay nuclear power station in Shenzhen proceeded as usual yesterday despite an earthquake in Guangdong province.

The Royal Observatory said it registered an intensity of three on the 12 point Modified Mercalli Scale. An earthquake with an intensity of four could cause windows and doors to vibrate.

Shenzhen authorities said the earthquake's epicentre was located at He Yuan, which is about 124 kilometres from the nuclear plant site.

The Guangdong Nuclear Power Joint Venture Company,

which is responsible for the $28.7 billion nuclear project, said the tremor did not affect the Daya Bay site and construction work continued as usual.

The Royal Observatory recorded the tremor at 10.05 am yesterday. Preliminary analysis showed the earthquake originated about 180 kilometres north-northeast of Hongkong.

It said local residents had reported having felt the earthquake, which lasted for less than 30 seconds.

The two partners in the Daya Bay joint venture — the China Light and Power Company and the Guangdong Power Company — completed a site selection feasibility study in December 1980.

Detailed data on earthquakes in the Guangdong region are classified as Chinese national secrets and were not released in the final report.

But the companies concluded that, even though a serious earthquake may occur in the region in the next 600 years, the Daya Bay site was safe for the construction of a nuclear power station.

Emergency Plan by December

Hong Kong HONGKONG STANDARD in English 24 Sep 87 p 2

[Article by Andy Ho]

[Text]

CONTINGENCY plans for a major nuclear accident at Daya Bay will be released in December in a Government consultancy report on the topic.

Yesterday's announcement came on the first anniversary of the signing of the major Daya Bay contracts in Beijing.

Miss Annie Tam, assistant secretary for Economic Services, said the United Kingdom Atomic Energy Authority at Harwell would submit its recommendations to the Government next month.

Copies of the draft report will be circulated to relevant departments for comment. The Harwell experts then will be asked, if necessary, to polish up the draft in response to the Government's remarks.

The final report will be tabled to the high-powered Government Committee on Contingency Planning for endorsement.

Miss Tam said it would take some time to translate the technical report into Chinese before it could be sent to the printer for mass production.

"It is optimistic that the report will be available to the public by the end of the year," she said.

The updated schedule suggests the Government will have about four years to drill its rescue units and to educate the public in the event of a nuclear mishap.

Nuclear fuel will be loaded into the Daya Bay Reactor Unit 1 by March 1992. International safety regulations require that a comprehensive emergency plan for a nuclear power station be ready before the first consignment of radioactive fuel arrives.

Meanwhile, the anti-nuclear coalition has criticised the Legislative Council's ad hoc group on Daya Bay for its "slow progress."

Rev Fung Chi-wood, who heads the Joint Conference for the Shelving of the Daya Bay Nuclear Plant, yesterday said many of the Omelco group's pledges had turned out to be empty promises.

He said little had been achieved to allay public concern over the safety of the nuclear project.

"The councillors' call for an advisory committee with public members to monitor the Daya Bay developments has remained just a proposal after a year," he said.

"The Omelco group convenor, Mr Wong Po-yan, demanded in early March that a Government nuclear information centre be set by September. But nothing has been done in this regard either, since then."

Members of the Omelco group will visit the Daya Bay site later this year.

/13046

SUBMISSION OF PARALLEL PROGRAM TO IAEA MONITORING ADVISED

51002006a Sao Paulo O ESTADO DE SAO PAULO in Portuguese 24 Sep 87 p 3

[Editorial: "Brazil and the Bomb"]

[Text] The ambassador of the Soviet Union was allowed to criticize the decision of the Brazilian Government not to submit its parallel nuclear program to the safeguards of the International Atomic Energy Agency (IAEA). "When there is submission to those international norms, there is no suspicion," Viktor Isakov stated. Curt and plain. And that, one week before the arrival of Minister Eduard Schevardnadze on an official visit during which he is to sign an economic, industrial, scientific and technological cooperation agreement in Brasilia. According to the explanation of Counselor Vladimir Stolinrov, who evidently is his subordinate, the statement was devoid of any intention to publicly censure the Brazilian position, when the country refused to sign the Treaty on the Nonproliferation of Atomic Weapons and submit to the inspection exercised by the IAEA. Be that as it may, it was a statement to the press--and public.

What would it mean to Brazil to subscribe to the treaty and be willing to be inspected? Suffice it to give one example. If any of the apparatus, instruments or parts of the facilities mounted to promote the enrichment of uranium (even a screw!) is directly or indirectly submitted to the AIEA's control safeguards, that international agency will have the right to inspect everything. There is constant preoccupation among the governments of the big powers about preventing the number of members of the "atomic club" from multiplying so that bombs will not be springing up here and there, presenting risks the gravity of which it is not necessary to stress. In exchange, the IAEA renders assistance to the signatories of the treaty in the development of research conducted to utilize nuclear energy for peaceful purposes linked to development.

The fact that Brazil has not signed the document that would bar actions aimed at building the bomb, by itself, raises the suspicion that the intention exists here to bring the country into that "club," the membership rolls of which are no longer that restricted and include representatives of the Third World... But there is an aspect of the Soviet ambassador's remarks that cannot pass without comment. Can one imagine if the words we have cited here had come not from him but from the ambassador of the United States? The "club of the left" would launch into violent criticism of him for meddling in the internal affairs of

Brazil, etc. The long litany is well known, always applied against the power that performs the task of leading the West. However, since the scolding comes from another side (and the opposite way), the Foreign Ministry itself reacted to it with gentle words framed in generalities: "Our foreign credibility is the guarantee of our position." And nothing more was said.

What can be called the art of patrolling has been perfected in Brazil. Any attitude adopted to express loyalty to the nations that make up the free world is immediately censured and whoever subscribes to it exposes himself to being ridiculed by the pseudointellectuals who turn up their noses at President Reagan, but do not hesitate to confess that they are crazy about dictators such as Castro and Ortega. Freedom of the press is a problem that does not interest the "patrollers"; or rather, freedom in general. If it was throttled in Cuba and Nicaragua, too bad; if it exists to exalt U.S. democracy, it must be ignored. Here, they will avail themselves of freedom only to attack the established order and to get their hands on the government. Once they climb to the seat of authority, they will not hesitate to revoke the right to denounce the abuses of the wielders of power, or demand that they observe the law.

It should be emphasized that there is no valid reason why Brazil should not subscribe to the Nonproliferation Treaty. Every government in this country has reiterated that it does not harbor any intention of achieving the bomb. Then why stay out and reject the cooperation that would come from signing the agreement? As a matter of fact, the resistence raised against it without mentioning valid reasons to repudiate it arouses suspicion. The bomb still seems to be one of the national objectives so that this country may assert itself as a great power. With the bomb ready... It so happens that there are more things on which to apply the substantial sums that would be diverted from the essential (investments for development that will open society and raise the standard of well-being of the people) and channeled into the superfluous, in the event that we are really pursuing some instrument of destruction based on atomic fission. Used for peaceful purposes, it would help the country. But in such a case, it would be very advisable to change the less sensible sovereign decision to the more sensible one and submit to the supervision exercised by the IAEA.

8711

NIGERIA OFFERS URANIUM IN EXCHANGE FOR ENRICHMENT TECHNOLOGY

51002006b Sao Paulo O ESTADO DE SAO PAULO in Portuguese 11 Sep 87 p 6

[Text] Brasilia--The new Nigerian ambassador-designate to Brazil, Patrick Cole, revealed yesterday that the government of Nigeria--a country that has a large quantity of uranium--is interested in establishing cooperation programs with Brazil in the area of nuclear energy. The intention is to export its uranium, which is considered to be of good quality, and in exchange acquire Brazilian uranium enrichment technology.

The ambassador, who has not yet presented his credentials to President Sarney, arrived in Brasilia on Monday with various projects to expand trade relations between the two countries. In addition to the programs in the nuclear area--an idea that has not yet been discussed between the two sides--during his stay in Brazil, Patrick Cole plans to intensify talks with PETROBRAS so that the may enter the Nigerian domestic market which, according to him, is being dominated by U.S. and European firms.

Since Brazil is one of the biggest purchasers of Nigerian oil and maintains a repurchase system--that is, it purchases the crude oil, refines and exports the derivatives over there--the government of that country wants PETROBRAS to create joint-ventures with Nigerian companies to promote the direct sale of all derivatives. According to Ambassador Patrick Cole, PETROBRAS has already shown interest in conducting this type of operation. Nigeria also plans to sell coal to Brazil. "We know that Brazil does not have good quality coal and some Brazilian companies are seeking agreements in this area," declared Patrick Cole.

Brazil's trade exchanges with Nigeria--the figures for which are higher than trade with several European countries--are based mainly on the purchase of Nigerian oil and the sale of Brazilian sugar, in addition to the purchase of 30 Tucano planes (built by EMBRAER) by the Nigerian Government.

In 1985, the trade balance between the two countries reached about $2.3 billion but last year it dropped considerably, to approximately $600 million. Ambassador Patrick Cole explained that this reduction occurred because of the drop in the world price of oil and the increase of [the price of] derivatives in the Brazilian domestic market, causing the reduction of consumption. "As a result of those two factors, Brazil purchased less oil, and Nigeria, with financial problems, purchased less sugar. Now we plan to regain the figures achieved in 1985," declared the ambassador.

SCIENTIFIC COMMUNITY VIEWS FUTURE CAPABILITY TO PRODUCE BOMB

Damy Dispels Bomb Hypothesis

51002004 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 6 Sep 87 p 4

/Article by Eymar Mascaro/

/Text/ "Only after establishing an adequate organization and investing billions of dollars--perhaps from 5 to 10 percent of the country's total foreign debt--would Brazil be able to attempt to produce an atomic bomb. Until that time, we would be able to make a bomb only on paper." This observation was made yesterday in an exclusive interview with O ESTADO DE SAO PAULO by Professor Marcelo Damy de Souza Santos, one of the most highly esteemed authorities of the scientific world and former chairman of the CNEN (National Commission for Nuclear Energy). Currently professor of physics at the PUC, Damy went a step further in his analysis of the situation in giving his assurance that Brazil would engage in the atomic energy field with only one intention: to use atomic energy for peaceful purposes to the exclusion of all war-related activities.

"The only ones who are raising the question of the atomic bomb are the journalists. Any scientist with a minimum of knowledge about the basic principles of the functioning of an atomic bomb knows that a project of that nature would involve enormous effort by a major scientific staff and a substantial amount of time for its realization," asserted Damy. Prof Marcelo Damy returned from Brasilia yesterday and upon his arrival in Sao Paulo stated that he had discussed this subject with President Jose Sarney. "No Brazilian scientist is concerned with atomic bombs and, if any of them broaches the subject of the bomb, I can only conclude that he is doing so through ignorance of the subject or through bad faith," Damy said. The professor was still more explicit in his remarks stating that if Brazil hoped to develop an atomic bomb it would have to wait at least 10 years to build a large complex for the enrichment of uranium with thousands of other centrifuges to process the raw material used as the nuclear explosive.

"An installation of that type requires investments of billions of dollars. It would also be necessary to construct particle accelerators to study the behavior of the interactions of high-energy neutrons with uranium 235, since, as is well known, those nuclear parameters are secret until now," said the Sao Paulo professor who in 1964 was relieved of the chairmanship of the CNEN and replaced by

a colonel for having been considered subversive by the revolucionary military of 1964. To develop the activities cited by Damy, it would first be necessary for the country to train nuclear physicists specialized in studies on high-energy neutrons "and no one trains a competent research physicist in less than 10 years. As can be seen, we would need more than 10 years to obtain the raw material required to begin the research which would then lead to a mathematical model of the bomb. In short, until that is achieved, we could make the bomb only on paper and, speaking in terms of the next 10 or 15 years, any forecast would be pure speculation."

A Specialist

Prof Marcelo Damy was born in Campinas in 1914 when World War I was just beginning and the atomic cycle was not yet a reality. He studied at universities in England and the United States and held some of the highest positions in the area of scientific research, being one of those responsible for the installation of the atomic reactor at the USP. A large part of the autonomous nuclear program in Brazil was developed when Damy was director of the Institute of Atomic Energy, now IPEN, between 1956 and 1961 and when he was chairman of the CNEN during the administrations of Janio Quadros and Joao Goulart, until the military removed him from that position. From 1964 on, he was threatened with dismissal and was constantly under surveillance, but he went to UNICAMP, founded the Institute of Physics and helped repatriate certain Brazilian scientists who had been exiled, among whom were Sergio Porto, Nelson de Jesus and Rogerio Cerqueira Leite.

It is with those credentials that Prof Damy has exalted the country's pacifist position asserting that the country's atomic effort would be directed toward peaceful objectives. The professor believes that the success reported by President Sarney is owed to the high level of competency of the teams of scientists working at the energy and nuclear research institutes of Sao Paulo, the support which those teams have been receiving from Rex Nazare Alves, chairman of the CNEN, the assistance of the Presidency of the Republic and the high level of cooperation being given since 1980 by a group of nuclear engineers of the Brazilian Navy.

"The important point and one which should be stressed is the fact that Brazil's technology was totally developed in our country, that it is not a copy of any foreign model and that there is not a single bolt which is not of national manufacture," declared Damy in reference to the progress of Brazilian technology in the atomic domain. "Here we have proof of the capability of the Brazilian scientists without help and without the import of any know-how," he said. Damy went on to say that atomic energy is of fundamental importance, that its radiations and radioactive isotopes produced in reactors have many applications in medicine, agriculture, food preservation and industry. The acquisition of those isotopes in recent times "has been a matter of continually increased effort in the work carried out by IPEN since 1957, but the demand is such that it would be necessary to operate this reactor at greater power during a longer period. This has not been possible because of certain difficulties in the United States and

other countries which produce enriched nuclear fuels and all of which belong to the so-called London Club."

Observation

The following observation was made by Prof Damy regarding the production of the Brazilian atomic bomb: "Any speculation in this respect is pure fantasy. It can only be the feverish dream of a nucleophobe."

Possibility of Bomb Within 5 Years

51002004 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 5 Sep 87 p 4

/Text/ The realization of the autonomous nuclear energy program announced yesterday by President Sarney could enable Brazil to produce its own atomic bomb within 5 years. This assertion was made by Jose Goldemberg, one of the country's most highly respected physicists and professor and rector of Sao Paulo University, who attended the Brasilia meeting held for the purpose of making the program official. Goldemberg stated that the decision whether or not to produce atomic bombs is strictly political and that, if the country decides to pursue that alternative, the Brazilian scientific community will have no control over the matter. And despite the peaceful connotation attributed to the government's program, the professor is not certain that the project will not be used for military objectives.

"As soon as we obtain sufficient technology, that technology can be used for peaceful as well as military purposes," said Goldemberg, recalling that he had proposed an amendment to Constituent Assembly reporter Bernardo Cabral whereby the new Constitution would include an article guaranteeing that Brazilian nuclear energy would be used solely and exclusively for peace. He also stated that the pilot unit to be installed in Ipero near Sorocaba is insufficient for the production of atomic bombs, since the industrial scale foreseen is for 50 to 100 machines equal to those used by IPEN (Institute for Nuclear and Energy Research) which operate in accordance with the ultracentrifugation process. According to the professor, the Ipero centrifuges will be able to enrich only 15 to 20 percent of the required uranium, whereas, to produce a bomb, we need 5 kilos of that material purified at 90 percent with 3,000 machines working in series. But in Goldemberg's opinion, the autonomous nuclear program also signifies Brazil's independence which is now making it possible for our country to turn down cooperative projects with other countries and embark on the development of our own technology beyond the control of international organizations. The program being carried out in cooperation with the Germans, as in the case of Angras I and II, is becoming secondary, an old claim of the Brazilian scientists. In Goldemberg's opinion, making the program official--"a program which was always carried out under lock and key and in complete secrecy and is no longer secret having entered the official domain"--is one more indication of its political nature, since there are few countries (the United States, USSR, England, France, China, India, West Germany and Argentina) which possess the technology required to enrich uranium.

Brazil Does Not Control Nuclear Cycle

51002004 Rio de Janeiro O GLOBO in Portuguese 5 Sep 87 p 7

/Text/ Campinas--Brazil's complete control of the nuclear cycle is still far off, according to physicist Rogerio Cesar de Cerqueira Leite, professor emeritus of the University of Campinas (UNICAMP) and president of the Technology Development Company. He considers the announcement made yesterday "one more attempt by Nuclebras to mislead the country's leaders in order to survive." He emphasizes that complete control of nuclear fuel is much broader in scope than the simple enrichment of uranium at 1.2 percent achieved by IPEN.

"The complete cycle consists of three stages: the production of the fuel, the use of that fuel to extract energy and, lastly, the reprocessing of the used fuel to recover materials present in the residue, such as plutonium."

Even with regard to the production stage, Cerqueira Leite expresses reservations concerning IPEN's results:

"Uranium enriched at 1.2 percent serves no purpose. Moreover, commercial production is much different from laboratory quantities. Reactors like those of Angra require uranium with 3 to 3.2 percent enrichment and only one of them, the Angra II, must consume about 1,000 tons of fuel per year. This is still not enough. It is also necessary to produce economically, for the problem is to produce with relatively low energy expenditures."

The scientist goes on to say:

"They speak of gaining control of a technology as if they were speaking of controlling a horse. In the beginning, the trainer does nothing but fall. After numerous attempts, he manages to fall only now and then. He then says that he is in control of the animal. In the nuclear domain Brazil does not even produce fuel for its reactors and already speaks of being in control of the complete cycle."

In his opinion, it is highly illogical to speak of controlling the complete fuel cycle for peaceful applications: "Applications in medicine or agriculture require other isotopes, never uranium. The uranium cycle is concerned only with energy applications and with war-related derivatives. The third stage of that cycle refers to the recovery of useful materials, principally plutonium, from the residue of the used uranium."

Cerqueira Leite explains that plutonium in turn serves for only two purposes: the production of bombs or the activating of so-called regenerative reactors, which Brazil does not have.

He therefore states emphatically that, in Brazil's case, "controlling the complete cycle means using plutonium for nonpeaceful applications. However, we are still far from that point: First, it would be necessary to produce enriched uranium at the required level, in sufficient quantities and under economical conditions. Then we would have to design and install adequate reactors. Only then would we arrive at the reprocessing stage."

Physicist's Forecast

51002004 Rio de Janeiro O GLOBO in Portuguese 5 Sep 87 p 6

/Text/ Sao Paulo--"Within 5 years at the most Brazil will be able to produce an atomic bomb and be closer to the nuclear powers." This forecast was made by physicist Jose Goldemberg, rector of Sao Paulo University, who stressed however that this is not the intention of the government or the scientific community.

"To produce the bomb, we need 5 kilos of highly enriched uranium, and this is far removed from our national capabilities," said the USP rector. Meanwhile, Goldemberg pointed out that the reprocessing of uranium yields plutonium, an element controlled by the International Atomic Energy Agency, and that it would therefore be possible to achieve the bomb in even less than 5 years.

The National Nuclear Energy Council will be responsible for carrying out the program; however, any decision to use it for military objectives would be one of government policy, according to Goldemberg.

"But the technology is not being devoted solely to peaceful purposes," said the scientist, citing as an example the case of the high-quality steel produced in Brazil which serves for kitchen knives as well as for "Urutus" automotive bodies.

Concern over the main objective of the new program was also expressed by Professor Luiz Carlos Menezes of USP's Institute of Physics. However, he believes that with uranium enriched at only 1.2 percent, as was reported, the utilization of the program for military purposes is still only a remote possibility.

"Apparently, we are just taking another step in our search for autonomy. It is not complete autonomy. And to achieve a technology free from safeguards, we need to state clearly that it is not our intention to produce nuclear weapons.

"A parallel program being carried out," commented Menezes, "was controlled entirely by the military, and it was not very clear what was transpiring within the organization, not to speak of the funds which were not always used in a legitimate manner." Menezes said that this is the best time to obtain guarantees with regard to the peaceful use of the technology.

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GOVERNMENT TO INVEST CZ65.2 BILLION FROM 1987 TO 1991

51002006c Sao Paulo O ESTADO DE SAO PAULO in Portuguese 16 Sep 87 p 20

[Article by Milano Lopes]

[Text] The government has allocated 65.2 billion cruzados (at April 1987 prices) to the nuclear program for the period 1987-1991, 47.5 billion of which will be spent by the Angra II and III plants alone. These investments in a program the priority of which has been increasingly questioned obviously contribute to increasing the public deficit and the foreign debt.

The nuclear program--another example of the national megalomania that gripped the government at the beginning of the last decade--was justified under false premises of electric generation needs. When time showed that the projections were wrong and the financial and exchange crisis befell the country, the program was gradually curtailed and today only two of the eight plants programmed are going to be built.

In 1974, when the nuclear agreement was being negotiated with Germany covering the period 1975-1990, it was guaranteed that the national hydroelectric potential did not exceed 100,000 MW and that the construction of the eight nuclear plants would prevent a collapse of the supply of energy anticipated by 1985.

In 1980, however, ELETROBRAS identified a potential of 213,000 MW, without considering the inventory of all the Amazonian rivers. The alternative of generating power in the far North and transporting it to the consumer centers in the Center-South Region by long-distance transmission systems began to be viewed as the most technically and economically feasible.

After that, the nuclear program began to shrink. In November 1982, it was decided that only four of the eight plants would be built. In August of the following year, the construction of the Iguape I and II units (the third and fourth plants of the curtailed program) were postponed.

In September 1984, nobody talked about the Iguape plants any more and the Angra II and III plants suffered another postponement, with the announcement

that they would not go into operation until 1990. In June 1985, when the Brazilian-German nuclear agreement was 10 years old and two-thirds of its full term had elapsed, its balance sheet was extremely unfavorable to the country: the investments had reached $4 billion and not a single nuclear electric kilowatt of power had been generated.

At the beginning of August of last year, the government announced another reduction of the nuclear program: the two Iguape plants were definitely forgotten and resources were concentrated on completing the two Angra plants--II and III--because of the volume of investment already committed. According to the new schedule, they will go into operation in 1992, and only at the end of 1989 will the government make a decision about proceeding with the program.

Angra II has 75 percent of its civil construction completed and 65 percent of its equipment has been acquired, while Angra III has almost half of its civil construction completed and almost 40 percent of its equipment has been acquired. To give up those two projects now would be to incur a greater loss than to continue to invest with the expectation that they can generate 2,600 MW one day.

Although Angra I has no direct relation to the nuclear program, it is very diligently contributing to increasing the public deficit and, thanks to the irresponsibility of the builders, the American Westinghouse Company, which supplied the equipment and assembled the plant, it is generating--when it does generate--the most expensive nuclear electric power in the world: $2,800 per kilowatt compared to an original forecast of $400 per kilowatt.

On 17 January 1985, when he inaugurated Angra I, the then minister of Mines and Energy, Cesar Cals, proclaimed in a public speech: "Angra I is no longer a firefly that goes on and off. It is a steady and reliable light." It was not. The problems never ended and continued to become aggravated to the point of the plant now suspending its power generation for an undetermined period of time until the defects are eliminated. When that occurs, Angra I will again operate its 626 MW of steady power at full load. The cost per kilowatt will have exceeded $3,500, almost three times that of Itaipu.

According to the projections of the Governmental Action Program (PAG), which the government will release with the next few days, between 1987 and 1991 the investments allocated to the NUCLEBRAS Group will total 65,248 billion cruzados. Those investments in millions of April 1987 cruzados are divided as follows:

INVESTMENTS	1987	1988	1989	1990	1991	87/91
Angra II	6,478	8,055	5,749	2,528	889	23,688
Angra III	1,160	2,263	4,114	3,547	5,191	18,275
Others	1,467	326	254	233	17	2,297
Operational	4,852	3,891	4,116	3,824	4,305	20,988
TOTAL	13,957	14,524	14,233	12,132	10,402	65,248

It must be pointed out that NUCLEBRAS considers its operational activities as investments, considering that the group does not have any operational revenue, even though in the listing of the sources of funds for the nuclear sector a grant of 7.428 billion cruzados is provided for as the group's own funds.

The major portion, however, will be borne by the Treasury, which up to 1991 will invest 43,233 billion cruzados in NUCLEBRAS, corresponding to almost 70 percent of total investments. The program provides for an allocation of 15.838 [as published] cruzados of foreign loans; however, it does not indicate the source of those funds, although they are to be furnished by Germany in the form of equipment for the Angra II and III nuclear plants.

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NAZARETH ON PROGRAM COSTS, ACTIVITIES UNDER NEW CONSTITUTION

51002005 Sao Paulo ISTOE in Portuguese 16 Sep 87 pp 72, 73

[Interview with CNEN Chairman Rex Nazareth Alves by Paulo Vasconcellos on 9 September: "A Case of Sovereignty"; first paragraph is ISTOE introduction]

[Text] The 49-year-old Rio de Janeiro physicist Rex Nazareth Alves did not even have time to celebrate the greatest Brazilian achievement in the nuclear field, as announced last week by President Jose Sarney: namely, complete mastery of the technology of uranium enrichment--a development that has made Brazil a member of the exclusive club of nations that have the capability to produce the atomic bomb. As chairman of the National Commission for Nuclear Energy (CNEN) for the past 5 years and coordinator of the secret program which in 8 years has consumed the equivalent of 20 billion cruzados and mobilized almost 4,000 technicians and scientists, 18 universities, and 150 industries, Rex Nazareth has spent the past several days packing his bags. He is leaving this Sunday for Vienna, Austria, for one more annual UN atomic energy meeting, where he will advocate the Brazilian position in favor of national independence in the development of nuclear energy. A fanatical fan of the Flamengo soccer team who can no longer find time to go to the stadium to see his team play and who has not taken a vacation in 16 years, the CNEN chairman nonetheless set aside an hour in his burdensome schedule last Wednesday to talk to ISTOE and to advocate a program that he realizes will at the very least start a controversy. "With the president's announcement," Rex Nazareth promises, "the independent nuclear program will now become more open to view." He is opposed, however, to having the new constitution state explicitly that the nation will forgo the atomic bomb.

[Question] What course will the Brazilian nuclear program take now, following the announcement that our country has mastered the technology of uranium enrichment?

[Answer] Investments will probably remain at around $40 million per year until the middle of the coming decade. The total amount invested to date comes to a little less than the equivalent of $400 million. No estimate has yet been made of requirements in terms of equipment, but it is already possible to predict the establishment of model industrial units to accommodate research programs and other small-scale programs. In the area of social benefit, the goal is to try to increase the level of nationalization of the equipment used in health care, agriculture, and industry. In the area of the

export of nuclear fuel, we are developing the capacity to compete for a market that varies between $10 billion and $15 billion.

[Question] When will the practical effects of this progress begin to be felt?

[Answer] They are already being felt. Today, the level of nationalization of nuclear radiation equipment used in medicine is already almost 70 percent. At the level of nuclear development that has been achieved, 10 percent of exports of beryl can now be made in the form of beryllium carbonate or beryllium oxide--a fact that suggests the birth of a new chemical industry. In the mechanical sector, a series of systems that used to be imported is beginning to be produced here. More than 100 kinds of electronic equipment have been developed, and some of them are already in use in private industry.

[Question] Is it yet possible to forecast an economic return on the investment, when the amounts still being invested are infinitely greater than the opportunities for short- or medium-term business transactions?

[Answer] Contrary to published reports, the amount spent annually on the independent nuclear program is less than the equivalent of $40 million. What should be emphasized, however, is the fact that the program represents an effort to utilize domestic raw materials and that it provides Brazil with the opportunity to export processed raw materials, with the result that the prospects for realizing an immediate financial return for the nation are potentially greater than if we maintained the so-called primary position of merely exporting raw materials.

[Question] Wouldn't our recent past in the field of nuclear energy appear to refute all that optimism?

[Answer] We are in no way associated with any agreements signed in the past. Our "past" relates to the independent nuclear program, which has revealed that our country is perhaps richer in these resources than the others, and the results of that program are becoming apparent and are incontrovertibly positive.

[Question] Are not the opportunities for profit outweighed by the danger of short-circuiting our relations with other countries--and especially the United States?

[Answer] Independence is something for which a people must fight. No one helps anyone to be independent and sovereign. In every process of development, however, it is only natural that whoever has already mastered a given technology will place obstacles in the path of another, to prevent the latter from sharing in this international market. We have now achieved independence in the nuclear sector, using Brazilian scientists, Brazilian raw materials, technology that is 100 percent Brazilian, and assistance from Brazilian industry. In this way, no pressure of any kind can prevent the nation from pursuing its destiny.

[Question] Why produce enriched uranium on a large scale if Brazil has only one nuclear power plant--which does not even function properly--and if the atomic submarine project will not be realized until after the year 2000?

[Answer] The talk is not of producing on a large scale, but rather of a system of small production units that can grow according as national requirements increase. It is a question here of more than independence: it is a question of ensuring a supply of fuel for the research reactors when it is impossible to import it. The most expensive fuel in the world is the fuel that one does not have. And the truth is that since 1979 Brazil has not been able to buy so much as a gram of fuel for its reactors.

[Question] What position do you think the Constituent Assembly will adopt in relation to the new possibilities for the Brazilian nuclear program?

[Answer] I believe that Brazilian interests will be fully protected in the new Constitution. We have even asked the Congress already to add an article that will define the nation's nuclear activities as being exclusively for peaceful purposes and that will enable those activities to be debated and monitored by Congress.

[Question] But what if the members of the Constituent Assembly opt for a more explicit version--one which says that Brazil will not undertake to make an atomic bomb?

[Answer] That is the kind of language you will find in the atomic weapons nonproliferation treaty, which is discriminatory. We want the article in question to be written in another way--and this is not a mere quibble over words. To say that our nuclear activities will be exclusively for peaceful purposes means that we shall not be making atomic bombs. To be more explicit than this would be contrary to the national interest.

[Question] Even if it does not lead to the bomb, doesn't the evolution of this program represent a threat to the ecology?

[Answer] We are in a phase of development, not one of large-scale nuclear installations. The risks are therefore less. An entire complex of safety procedures is nonetheless in place, and environmental impact studies are being prepared to support it.

[Question] What was the real necessity for carrying out this nuclear program heretofore under the classification of "secret" or the equivalent?

[Answer] In actual fact there never was a classification of "secret" or anything similar. What happens is that when a research institution or an industry develops a new product, it automatically protects the technology from the competition.

[Question] If the program was not classified secret or the equivalent, what is the explanation for the secret Delta accounts, with money deposited in banks in behalf of members of the National Commission for Nuclear Energy?

[Answer] In a speech I made to the Congress I made it very clear that the success of the Brazilian nuclear program was dependent on maintaining a minimum of secrecy. I also pointed out that only a small part of what was carried out under the program had to be kept secret. In addition you have the National Accounting Office, which monitors and maintains total control even over secret systems. The National Congress also is empowered to carry out this monitoring, to ensure the legitimate application of the public funds. According as the results are obtained, however, it will be possible eventually to have complete openness, even to the point of placing the entire program under the authority of Congress.

[Question] What is the situation with the installations at Resende, where $350 million has already been consumed in developing the centrifugal jet process?

[Answer] A series of demonstration tests is going to begin at that unit so that the investments made there will not be wasted. NUCLEBRAS [Brazilian Nuclear Corporations, Inc.] has already arranged for the export of low-grade enriched uranium produced at Resende; this could represent recovery of these investments. I anticipate that this unit will not be called a "white elephant."

[Question] How was it possible to unify the scientists--some of whom had always been resistant to the Brazilian nuclear program and to the military--behind this project?

[Answer] In 1979 it became clear that Brazil would not be able to purchase a guaranteed supply of nuclear fuel over the long term. It also became clear that Brazil would not be able to obtain fuel for its research reactors. It was therefore essential for Brazil to develop its own technology, and we proceeded to unite the efforts of 18 universities, 150 industries, and a number of research institutions both civilian and military. It was not the first time that the military had participated in a national program of independent development; this had already taken place in the areas of communications, computer systems, iron and steel, and petroleum. The military have always had a deep-seated spirit of nationalism.

10992

SITES OF NUCLEAR FACILITIES IN RIO, URANIUM RESERVES DEFINED

51002006d Rio de Janeiro O GLOBO in Portuguese 5 Sep 87 p 7

[Text] Rio de Janeiro may be considered today the nuclear enclave of the nation. Of the important facilities connected to the sector, only the Institute of Energetic and Nuclear Research (IPEN), the uranium mines, and the Navy unit that will develop the reactor of the nuclear submarine lie outside the state. Located in Rio are the headquarters of the National Nuclear Energy Commission, NUCLEBRAS, Furnas, and the Institute of Nuclear Energy, among others. NUCLEP (which manufactures heavy equipment for plants) is in Itaguai, the facilities for prospecting monazitic sands are in the North Fluminense, and the fuel element and separation element factories are installed in Resende. Also planned for the region are the uranium reprocessing plant and the plant for uranium enrichment by centrifugal jet. The only nuclear plant in operation in the country (Angra I) was built in Angra dos Reis, and Angra II and III are scheduled. The nuclear plants that were to have been erected on the southern coast of Sao Paulo (IGUAPE) were canceled due to their high costs and the pressures of ecological groups.

Brazil ranks fifth in the world in terms of uranium reserves--301.4 tons [all figures as published]--being surpassed, in order of size, only by the United States, Canada, Australia, and South Africa. Nevertheless, NUCLEBRAS does not include Brazil among the biggest producers of uranium in the world because production on a commercial scale began about a year ago. The four largest producers also have the largest deposits, except in a different order; Canada is the largest producer, with 13,500 tons, followed by the United States, with 6.4 tons; South Africa, with 5.6 tons; and Australia with 4 tons.

The largest uranium reserve in Brazil is in Itataia, in Ceara, with 142,500 tons. But there are reserves in Figueira (Parana), with 8,000 tons; Lagoa Real Bahia, with 96.1 tons; Espinhais (Paraiba), with 10,000 tons; in addition to the small ones in Goias and Para, which together amount to 21,000 tons. Of the latter, the only deposit that is being processed is that of Pocos de Caldas (Minas Gerais), with reserves of 26.8 tons.

Key:

1. Headquarters: NUCLEBRAS, CNEN, IRD, Furnas
2. Heavy equipment factory
3. Nuclear power plant
4. Separation elements factory
5. Fuel elements factory
6. Planned: Reprocessing plant; plant for enrichment by centrifugal jet
7. One of the regions studied for the storage of atomic waste of low and medium radioactivity
8. NUCLEMON

URANIUM GEOLOGIC RESERVES
(in metric tons of U308)

Deposits/Mines	Type of Reserve		
	Measured & Indicated *	Inferred **	Total
1. Cercado Mine (Osamu Utsumi) Pocos de Caldas, Minas Gerais	20,000	6,800	26,800
2. Figueira, Parana	7,000	1,000	8,000
3. Phosphorous/Uranium-bearing deposit of Itataia, Ceara	21,200	51,300	142,500
4. Uranium-bearing deposit of Lagoa Real, Bahia	61,840	31,350	93,190
5. Espinharas [as published] Paraiba	5,000	5,000	10,000
6. Other deposits (Goias, Para, Minas Gerais)	7,500	13,500	21,000
TOTAL	192,540	108,950	301,490

In the IAEA nomenclature, the types of reserves are equivalent to: * Reasonably certain; ** Estimated additions.

Source: NUCLEBRAS

8711

FRG FIRM TO STUDY NUCLEAR POWER PLANT FEASIBILITY

51500034 Dhaka THE BANGLADESH OBSERVER in English 10 Oct 87 p 3

[Text]

Bangladesh Atomic Energy Commission (BAEC) has signed an agreement with a West German firm for feasibility study of the proposed Nuclear Power Station at Rooppur. Capacity of the plant will be between 300 to 500 megawatt, reports BSS.

Official sources told BSS that the technical and socio-economic feasibility study will be completed within nine months at a cost of one million U.S. dollar.

The agreement was signed at Frankfurt on October one. Dr. Anwar Hossain, Chairman, BAEC, and Mr. H. Von Braunmuhl, Acting Managing Director, Lahmeyer International of West Germany, signed the agreement on behalf of their respective organisation.

The preliminary report of the feasibility study will be submitted within six months and the International Atomic Energy Agency (IAEA) has expressed its willingness to jointly examine the preliminary report with BAEC, the sources said.

Nuclear and financial experts feel that participation of IAEA in the feasibility study or at least the review of it could be decisive for its credibility to financing institutions and would have a positive influence on the lenders.

The feasibility study will determine the proper reactor type and the suitable technology, cost economics, possible sources of financing and special safety considerations. It will also examine the joint venture concept between BAEC and possible foreign suppliers for installation and operation of the plant.

The sources said that the proposed Unclear Power Plant would be envisaged as a commercial project and its cost economy and financing would be studied from that angle.

/13046

FORMER FOREIGN MINISTER URGES NUCLEAR PACT WITH PAKISTAN

51500030 New Delhi PATRIOT in English 10 Sep 87 p 4

[Article by Maharajakrishna Rasgotra]

[Text]

Nuclear non-proliferation is a myth propagated by nuclear weapon powers to perpetuate their monopoly of nuclear weapons and to retain control of the world market for peaceful applications of nuclear technology.

The Nuclear Non-Proliferation Treaty (NPT) of 1968 is the twentieth century's most audacious humbug. What is surprising is not its perpetration by the nuclear monopolists, but its easy, unquestioning acceptance by a large number of the World's non-nuclear countries.

Most of these latter are the erstwhile colonial possessions of Western imperial powers. They are developing countries with large populations who will need to harness the atom for their future energy and other needs. These are also the countries which missed the industrial and technological revolutions of the last three centuries.

The secret and sensitive nuclear technology of today will be the common industrial technology of the next century. If these countries are not to remain backward and dependent in future, they must acquire technical nuclear know-how for peaceful uses now.

There is a link between the commercial, civilian uses of nuclear power, and nuclear weapons technology. They both utilise the energy produced by the fission of uranium or plutonium atoms. The concept of a nuclear bomb is simple enough and its configuration into a workable weapon-design would be within the capabilities of almost any nation with some scientific talent, financial and industrial resources, and engineering skills at its command.

While a nation's capacity to build a nuclear arsenal is a technological question related to the quality of its nuclear facilities, the decision to build a nuclear weapon is a political one. Though I am personally opposed to nuclear weapons and consider them unusable in war, I believe each nation must be *free* to make its own political decision as to whether or not it will go nuclear in the military sense.

As a citizen of India, I have applauded and shared my country's decision not to go in for a nuclear military programme. Nevertheless, I cannot bring myself round to accepting the argument advanced by some nuclear weapon powers, especially the United States of America, that other countries must not develop nuclear weapons because these would constitute threats to their security and to global stability, or complicate their strategic planning. It would be a different matter if the world as a whole, including the present nuclear weapon powers, were to abjure nuclear weapons.

The South-Asian subregion is a rather small, integral part of the Eurasian landmass. Out of the globe's total arsenal of some 60,000 nuclear warheads, some 40,000 are deployed in and around Eurasia. Asia itself is significantly nuclearised with a concentration of about 15,000 nuclear warheads.

These weapons are all around us, to the subcontinent's north, east and west, in the Indian Ocean, the Arabian Sea and the Gulf. Naval ships carrying nuclear weapons regularly visit a large number of ports of Asian countries. Infrastructure for nuclear war fighting has been created in a number of them, including one or two in South Asia.

In our neighbourhood, threat and provocation continue to be flung at Iran which can only drive that country to the nuclear option. Israel with its clandestine nuclear armoury is good enough reason for its Arab neighbours to choose the nuclear path.

Regardless of whether in our own little subregion we possess or do not possess nuclear weapons, nuclear weapons belonging to China, the Soviet Union and the US hang over us from not so far away and are a threat to the security and well-being of our people. This is no argument for South Asia's nuclearisation, but any commitment of non-proliferation in our subregion must predicate on the dismantling of these other existing threats.

In today's world, non-proliferation cannot be rationally considered country by country or

on a subregional basis. The only practical way to proceed with it is in the global context. Non-proliferation to be meaningful must be vertical and it must begin with those who have done the most proliferating.

There is no such thing as nuclear defence of a non-nuclear country by a nuclear weapon power. There is, therefore, no legitimate reason for the positioning of any one country's nuclear weapons in any other country's territory. If we want to make a beginning with non-proliferation, we should have to start with the withdrawal of nuclear weapons of great powers to within their respective national territories.

In the South Asian context, the issue is generally phrased as follows: The acquisition of nuclear weapons by Pakistan and India will inevitably lead to a nuclear war between them; these weapons are not safe in their hands; at any rate, nuclear weapons are too costly for developing countries and by embarking on a nuclear arms race India and Pakistan could spend themselves to destruction; they must, therefore, be saved from themselves and made to sign the NPT and accept international surveillance and safeguards.

The argument gives little credit to either country for good sense, prudence and caution and for ability to discriminate between what is civilised and what is barbaric; it smacks of racial arrogance. It is hard to understand why the chances of a nuclear war between India and Pakistan should be rated any higher than chances of a nuclear war between the US and the USSR or between the USSR and China, or China and the US.

Non-proliferation is no longer the real issue in South Asia. Proliferation has taken place here and the task before us is that of living with it and controlling its spread. Pakistan has had a nuclear military programme for some time and is today a nuclear weapon power. India's technological capability dates back to the early sixties: it was effectively demonstrated in its peaceful, subterranean explosion at Pokharan in 1974.

It is equally obvious that India has not yet taken the necessary political and industrial decisions to translate its scientific and technological proficiency into weapon's capability. This is due to a genuine reluctance to depart from a policy, established by Jawaharlal Nehru, which is both courageous and wise, of abjuring nuclear weapons as a means of war or international politics.

Pakistan's emergence as a nuclear weapon power faces India with critical choices. It has two options: To keep a strong nerve and spurn the threat inherent in the new situation, and to continue with established policy; or, to develop and deploy nuclear weapons to counter the nuclear forces of both Pakistan and China. It is a tribute to Rajiv Gandhi's courage and wisdom and restraint that he has not rushed into the latter option.

The constraints in India are entirely those of policy, statemanship, and of concern for human destiny in a nuclear world. India can match Pakistan's nuclear force, and to the necessary extent China's, with reasonable speed. Public opinion in India is veering in that direction and its government may be forced on to this latter course, Prime Minister Rajiv Gandhi's deep personal aversion for nuclear weapons notwithstanding.

It is my belief that in the course of the next decade or two a score of other threshold countries will also go nuclear in the sense of developing explosion capability for weapons or peaceful purposes. They need to acquire this technological competence for independence as well as economy in harnessing nuclear energy for their future development. The behaviour of the present nuclear monopolists may leave them no other choice.

I for one would not bemoan such a development. Perhaps, only wider horizontal proliferation may persuade the present nuclear weapon powers to move forward towards an agreed programme of substantial and meaningful reductions in nuclear arms and to place their own nuclear facilities under international inspection and safeguards.

All the various non-proliferation proposals, so-called, mooted from time to time by nuclear weapon powers for South Asia should be viewed in this larger context. Their central purpose is to persuade India to sign the Nuclear Non-Proliferation Treaty.

India's objections to that Treaty are not of recent origin. They were spelt out clearly and forcefully when the Treaty was being negotiated. Experience of the actual working of that Treaty has amply demonstrated the relevance and validity of India's reasoning at the time against the Treaty's discriminatory character and its unstated purpose of legitimising the great powers' race of nuclear arms, their monopoly of nuclear weapons, and their hegemony over the non-nuclear world.

India's refusal to sign the Treaty had nothing to do with Pakistan. In 1968, Pakistan was among the more ardent champions of the Treaty which it hailed as the most important agreement on nuclear disarmament. I can understand Pakistan's later change of position and refusal to sign the Treaty. What is not easy to comprehend is Pakistan's willingness to be used as a bait to lure or pressurise India into the Treaty.

The other proposals put forward by Pakistan from time to time — a nuclear-weapon-free zone in South Asia, mutual inspection of Indian and Pakistani nuclear facilities, simultaneous acceptance of international inspection and safeguard, etc — are but variations on the NPT theme and India can hardly be expected to entertain them.

Personally, I am attracted to the suggestion that both India and Pakistan should renounce the acquisition or manufacture of nuclear weapons. India's policy thus far has, in fact, been one of voluntary and unilateral renunciation of nuclear arms. Pakistan is pursuing the opposite policy and clothing it in calculated ambiguity.

As a friend and well-wisher of Pakistan, I would urge its authorities to give up ambiguity. In any country's nuclear policy, I can

think of nothing more disturbing and dangerous than ambiguity. In a nuclear world, it is vitally necessary and infinitely more safe for countries to clearly understand where they stand in relation to one another.

Unless the pall of secrecy is lifted from Pakistan' nuclear programme and the cloak of ambiguity drops, there can be no question of even the first step towards a joint or parallel renunciation of nuclear weapons. Mutual inspections and verifications, etc will have to await developments of this kind — they cannot precede them.

As I said, proliferation has taken place in South Asia and, therefore, non-proliferation is no longer the real issue. The task confronting us is that of controlling its spread and sophistication. This calls for a sincere, serious and sustained dialogue between India and Pakistan.

I do not have fear of a nuclear war between India and Pakistan. In the two countries there are millions of divided families and I cannot easily imagine the authorities here in Islamabad or in New Delhi callously taking decisions to drop nuclear bombs on the other side's cities. Nuclear attack by one on the other, even in the absence of retaliation, would be disastrously self-damaging not only in terms of fall out and contamination, but also because of the economic, political and moral effects of the act.

Besides, we are two civilised societies, and unfortunate and tragic and frequent as our wars have been, neither India nor Pakistan took to genocidal bombing of the other side's cities and civilian targets, which was so often the case in the wars between industrialised Western nations. What we have to avoid in South Asia is a futile race of nuclear arms becoming a substitute for war or diplomacy as is presently the case in the East-West confrontation.

Security, especially in the nuclear context, cannot come from reliance on runaway technology. Only human beings, by mutual agreement and cooperation, can generate a true sense of mutual security. For this too we need a vastly better climate of relations between our two countries than the one obtaining at the moment.

The only proposal which has relevance in the subcontinent's current nuclear situation is for a binding agreement between India and Pakistan not to use nuclear weapons against one another under any circumstance. In our situation, even the "no first use" will not be sufficiently reassuring. From the "no-use" commitment we can proceed to exclude resort to any kind of force at all in our mutual dealings and to the establishment of agreed nuclear force levels with which both feel comfortable about their security. These would be logical developments following the recent agreement between President Ziaul Haq and Prime Minister Gandhi not to attack each other's nuclear facilities.

This contribution by former Foreign Secretary M Rasgotra and currently Chairman of the International Institute of Southern-Asia and Pacific Studies, is based on his paper presented at the International Conference on Nuclear Non-Proliferation in South Asia, recently organised by the Islamabad Institute of Strategic Studies

/12379

GROUNDWORK LAID FOR NUCLEAR POWER CORPORATION

51500029 Bombay THE TIMES OF INDIA in English 1 Sep 87 pp 1, 9

[Text]

NEW DELHI, August 31.

A WHOLLY-OWNED government company is expected to come into being to promote atomic energy as a major source of power.

The spadework for setting up the Nuclear Power Corporation of India Ltd. (NPCIL) is already complete. Based in Bombay, the corporation will supersede the nuclear power board. Its immediate aim will be to work on the production of 10,000 MW by the year 2,000.

Run on professional lines and with the kind of flexibility in commercial decision-making which the private sector has, the new company will work in co-ordination with state electricity boards and the Bhabha atomic research centre.

It is proposed that the NPCIL will go public to meet its capital needs. Tax-exempt bonds are expected to be floated in the capital market. The government calculates that the company will be self-reliant by 1995, and will not require budgetary support after that.

On present estimates, Rs 10,300 crores will be required to generate 10,000 MW of atomic power. The authorised capital outlay is Rs 2,500 crores — of this Rs 1,300 crores is available with the government in the form of existing assets.

One of the reasons for setting up the corporation is to allow the nuclear-electricity generating programme access to the capital market.

As Mr K. R. Narayanan, minister of state for science and technology, said in Parliament last week, funds are a major constraint in expanding the nuclear-power programme. In other respects, India is reasonably well-equipped to proceed with its atomic-electricity generating schedule, official sources claim.

Producing 10,000 MW of electricity through a nuclear source by the turn of the century is "certainly feasible technologically," Mr Narayanan said. The time for setting up an atomic reactor in India is about eight years as against 12 to 15 years in the U.S.

There are already three atomic stations in the country. More are under construction at Narora, Kakrapar, Kaiga and in Rajasthan.

They are expected to function by 1995 when 3110 MW of atomic power is expected to be generated. The present generation is only 1230 MW — barely 2.5 per cent of the nation's power output.

After 1995, the government envisages the setting up of 12 reactors of 235-MW capacity and ten of 500 MW.

The memorandum of articles of the NPCIL has been drafted. The NPCIL is expected to have ten directors on its board. The formal floating of the company now only awaits the assent of the President to the bill passed by Parliament. This is expected in a few weeks.

If the NPCIL achieves its immediate perspective of producing 10,000 MW in the next 13 years, nuclear power would account for ten per cent of the total energy output in the country.

Imported raw material and components like special steel would constitute only about ten per cent of the total resources employed. None of them would be in any sensitive area.

Besides producing power, the new company will be charged with the designing, construction and running of nuclear reactors.

The production of heavy water and the running of a fuel complex are managed by the atomic energy department now. In the not-too-distant future, these activities may also be brought under the purview of a separate corporation created for the purpose.

Atomic energy research, however, will continue to be done at the BARC.

The distribution of India's coal and water resources being what it is, the government feels the country should take recourse to diverse sources of energy.

On the present official reckoning, coal reserves are likely to be exhausted in a hundred years. Water resources are considered to be neither unlimited nor reliable. The state of research of solar and other nonconventional forms of energy does not make these commercially viable, at least for the time being.

The costs of producing nuclear electricity are said to be comparable with other sources, except for hydel which is found to be cheaper in some cases. But Mr Narayanan informed Parliament that it might be possible to reduce the cost of nuclear energy through standardisation and technological development.

/12379

PAPERS REPORT OPENING OF NUCLEAR POWER CORPORATION

Official's Inaugural Speech

51500054 Madras THE HINDU in English 17 Oct 87 p 9

[Text]

BOMBAY, Oct. 16.

Dr. M. R. Srinivasan, Chairman, Atomic Energy Commission and Secretary to the Government of India, Department of Atomic Energy, said here today that they had recently completed the construction of a reactor operator training simulator which would help in training and retraining of operating personnel. In addition to these specific plant related initiatives, the Atomic Energy Regulatory Board, set up three years ago, has been strengthened substantially to carry out licensing and review functions.

Dr. Srinivasan, who was inaugurating the Nuclear Power Corporation of India Ltd., said a programme of 10,000 MW of nuclear power by 2000 A.D. had been envisaged by the Union Government. This would consist of a series of 235 MW reactors followed by 500 MW reactors of the pressurised heavy water type.

Floating bonds: To increase the availability of financial resources for such a programme, the Government has decided to convert the Nuclear Power Board to the Nuclear Power Corporation, a company, under the Companies Act, 1956, he said. The corporation was at present working out a detailed mechanism for issue of bonds to the public. In the first issue, it was proposed to sell by December 1987/January 1988 bonds to the tune of Rs. 100 crores.

Referring to the recent Chernobyl accident and also the accident to the Three Mile Island reactor in the U.S. in 1979, he said greater reliance on operator training, qualification and requalification through the use of simulators, review of operating procedures by independent experts, apart from augmenting automated features for ensuring reactor safety even under abnormal conditions had been introduced in nuclear installations.

More recently an exchange of operating information and experience between all utilities around the world which were operating nuclear reactors had been proposed so that operators around the world would benefit from the experience to deal with off-design conditions or other abnormal situations at the reactor installations, he pointed out.

BARC link: Further he referred to the linkages of the Nuclear Power Corporation with other branches of the Department of Atomic Energy. The NPC would continue to depend on research and development inputs from the Bhabha Atomic Research Centre and other R and D groups within the department, he said. Similarly, the nuclear fuel complex had an important role in the supply of fuel elements and zirconium alloy components for the reactors. The heavy water projects were responsible for supply of a vital material required for the reactor programme. The Electronics Corporation of India Ltd. supplied essential control and instrumentation equipment for the reactor programme. All these linkages would not only have to continue but must be strengthened, he added.

In the past, the nuclear power stations of DAE had been supplying electricity in bulk to different State electricity boards. The NPC would henceforth take on the responsibility, he said. It would therefore participate in the deliberations of the regional electricity boards for effective coordination of generation and maintenance planning.

Nuclear Plants Described

51500054 Bombay THE TIMES OF INDIA in English 16 Oct 87 pp 24, 25

[Article by Shri K.P. Rao]

[Text]

At present there are three nuclear power stations in operation in the country located at Tarapur in Maharashtra, Rawatbhata in Rajasthan and Kalpakkam near Madras in Tamil Nadu. Each of the stations has two units in the 200 MWe range.

The two 210 MWe reactors at Tarapur Atomic Power Station (TAPS) were commissioned in 1969. Our contract with General Electric Co., USA, was executed in May 1964 and both the units were declared commercial in November 1969. Both the units of Tarapur, though of the first generation, have been operating satisfactorily and it is not a mean achievement that the two units have an average capacity factor of 51% and an average availability factor of 72% over the past 18 years. Due to down grading of some equipment both the units have been derated to 160 MWe since April 1985.

The TAPS reactors are similar to the early boiling water reactors (BWR) in USA and Western Europe. Based on the operating experience at TAPS and at other operating BWRs in the world, over 500 design modifications were carried out to improve the safety as well as availability of the units. With the experience gained during the past 18 years and with the improvements carried out, there has been a marked increase in availability of the units and reduction in the number of forced/ planned outages of the units. The units have established uninterrupted runs of about 200 days on several occasions.

Rajasthan Atomic Power Station (RAPS) located at Rawatbhata near Kota in Rajasthan was the first pressurised heavy water reactor (PHWR) in India which was commissioned in 1973. Although during the years 1979 and 1980 capacity factors of more than 50% were achieved, the overall performance of RAPS-1 has been rather poor because of grid problems and problems with conventional equipment like turbine, etc. In September 1981, RAPS-1 had to be shut down due to development of a light water leak in the south end shield. After temporary chemical plugging of the leak, the unit was synchronised again in 1982. The leak recurred in March 1982. After extensive studies and other development efforts, the cracks were sealed by mechanical methods and the unit was re-synchronised in February 1985. It operated for about 3 months satisfactorily and in May 1985 another leak appeared at a different location. This new crack and another crack noticed subsequently were fixed using special flanges and gaskets. The unit has again been started up in August 1987 and is presently being operated at about 100 MWe (50% power level).

RAPS-1 being a replica of the Douglas Point Generation Station in Canada, which is a prototype reactor, there were many deficiencies which showed up in its poor performance. However, based on RAPS-1 experience, improvements were carried out on the second unit of RAPS (RAPS-2) which have resulted in its better performance.

The second unit of RAPS was commissioned in October 1980 and was declared commercial in April 1981. The performance of this unit has been good. The cumulative capacity and availability factors are 54% and 71% respectively. Except for the initial two years of its operation, the annual capacity factor of the unit has been more than 50%. This unit has also established a high performance record during 1986 with an uninterrupted run of 163 days and availability and capacity factors of 77% and 70% respectively. In the first two years, there were problems with the turbine generator and one of the main coolant system standby coolers.

The Madras Atomic Power Station (MAPS) located at Kalpakkam consists of two units of 235 MWe. The commissioning of the first unit of MAPS in 1985 marked the culmination of the efforts to indigenise the design, construction and operation of nuclear power reactors. Further improvements based on operational experience from RAPS were incorporated to enhance the performance and reliability of the station. About 90% of all the equipment and components were made in the country. The first unit was declared commercial in January 1984. The performance of Unit-1 in the first year of operation was very encouraging. The cumulative capacity factor of the Unit is about 54% and the cumulative availability factor about 65%. The lower capacity factor was mainly due to deficiencies in the conventional equipment relating to higher vibrations on the Turbine and failure of Main Generator Transformer which have since been attended to. The performance of the unit has improved since then and an availability factor of 85% was achieved during 1987.

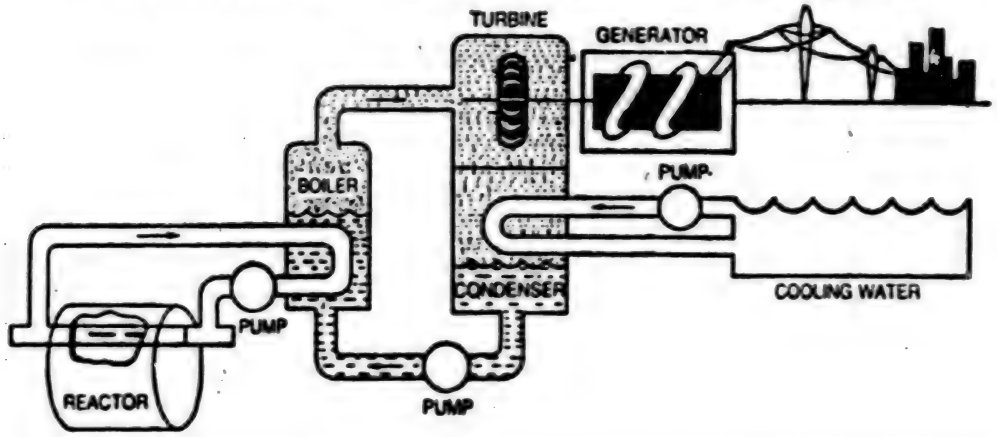
The second unit of MAPS was synchronised for the first time to the grid in September 1985 and commenced commercial operation in March 1986. There were some problems in the first year of operation. The main contribution to the unavailability of about two and a half months of the unit came from stuck spent fuel bundles in the fuel transfer system. During 1987, Unit-2 attained a capacity factor of 59% and an availability factor of 75%.

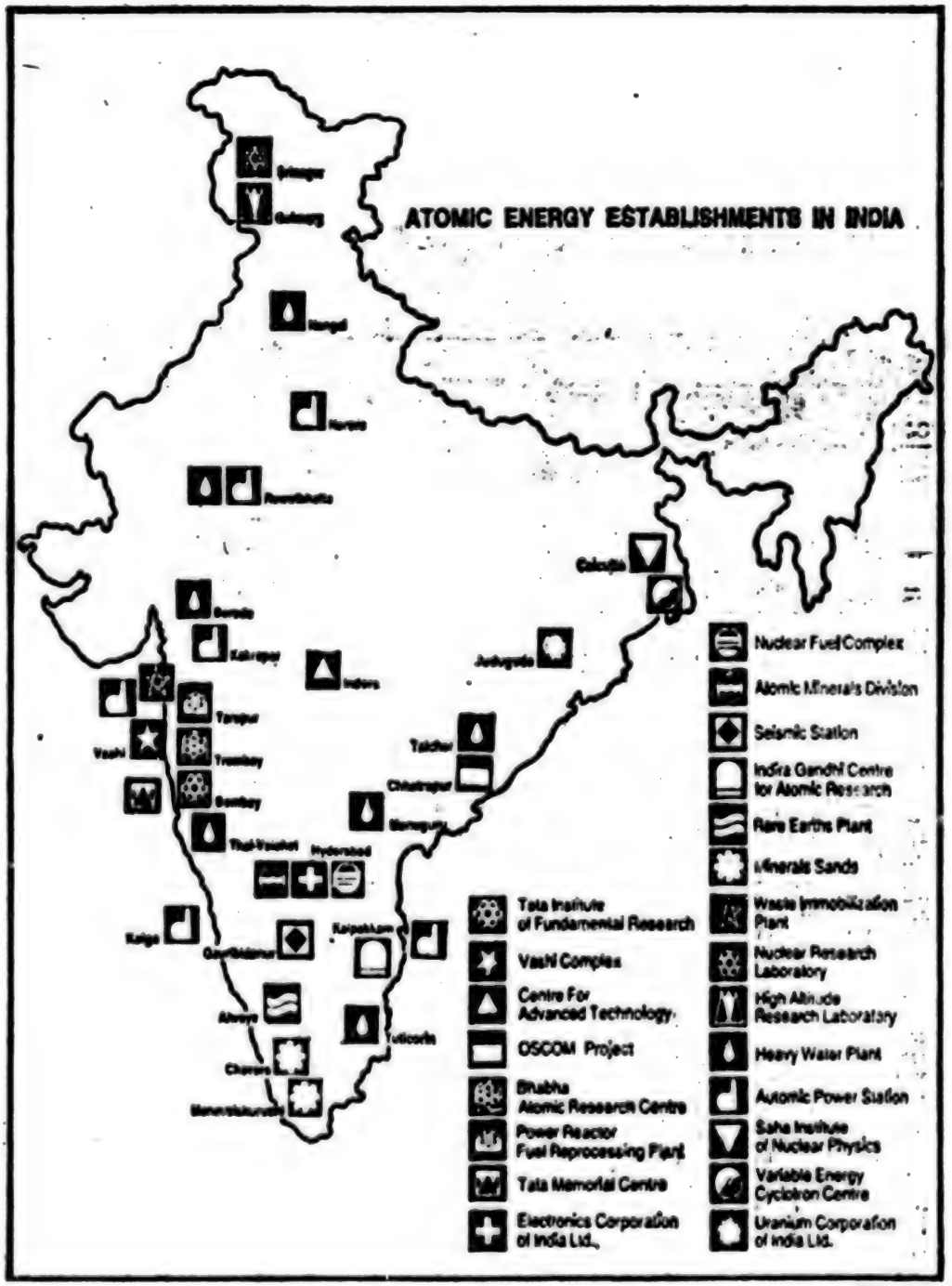
The subsequent Stations under construction/commissioning at Narora, Kakrapar, Kota (additional) and Kaiga are all of 2 units of 235 MWe each. The construction work at Narora is nearing completion and the first unit is expected to be operational during 1988 while the second unit is scheduled to be completed one year later. The civil construction works at Kakrapar are in full swing and the first unit is expected to be ready for operation during 1990-91 with the second unit one year later. The construction works on additional Units at Kota and at Kaiga are in the preliminary stage. With 50 reactor years of operational experience behind us, there is confidence that the performance of future stations would scale higher peaks.

PERFORMANCE OF NUCLEAR POWER PLANTS

Year	TAPS UNIT-1			TAPS UNIT-2			RAPS UNIT-1			RAPS UNIT-2			MAPS UNIT-1			MAPS UNIT-2		
	Availability factor (%)	Capacity factor (%)	Total No. of outages	Availability factor (%)	Capacity factor (%)	Total No. of outages	Availability factor (%)	Capacity factor (%)	Total No. of outages	Availability factor (%)	Capacity factor (%)	Total No. of outages	Availability factor (%)	Capacity factor (%)	Total No. of outages	Availability factor (%)	Capacity factor (%)	Total No. of outages
1969	93	54	6	86	50	5	—	—	—	—	—	—	—	—	—	—	—	—
1970	85	59	13	79	60	23	—	—	—	—	—	—	—	—	—	—	—	—
1971	59	46	6	68	51	6	—	—	—	—	—	—	—	—	—	—	—	—
1972	57	35	15	23	12	2	—	—	—	—	—	—	—	—	—	—	—	—
1973	59	41	15	85	68	14	89	49	2	—	—	—	—	—	—	—	—	—
1974	79	45	21	46	32	19	54	38	49	—	—	—	—	—	—	—	—	—
1975	66	50	3	65	50	8	44	34	31	—	—	—	—	—	—	—	—	—
1976	87	63	12	74	62	6	65	47	35	—	—	—	—	—	—	—	—	—
1977	70	54	15	85	68	7	38	27	11	—	—	—	—	—	—	—	—	—
1978	73	51	11	76	62	11	18	9	9	—	—	—	—	—	—	—	—	—
1979	82	53	6	71	54	6	82	65	14	—	—	—	—	—	—	—	—	—
1980	68	48	5	78	49	13	72	54	19	—	—	—	—	—	—	—	—	—
1981	68	43	12	77	52	9	43	26	13	80	44	21	—	—	—	—	—	—
1982	90	60	14	55	30	10	6	3	4	42	23	9	—	—	—	—	—	—
1983	62	43	6	86	57	6	—	—	—	76	55	15	—	—	—	—	—	—
1984	88	49	6	64	47	4	—	—	—	67	54	16	75	64	24	—	—	—
1985	71	58	7	92	78	5	22	13	6	71	59	15	55	46	13	—	—	—
1986	91	85	10	64	59	5	—	—	—	71	70	11	53	41	13	57	41	23
1987 (till July)	5	4	1	97	94	1	1	—	—	92	85	4	85	71	13	75	59	18

MAIN FEATURES OF PRESSURISED HEAVY WATER REACTOR (PHWR)





BRIEFS

PLANTS' NUCLEAR POWER PRODUCTION--Three nuclear power stations in Maharashtra, Tamil Nadu, and Rajasthan have been generating over 1,200 mw of power every day and efforts are on to generate 10,000 mw by the end of the century. Disclosing this to newsmen at Karwar in Karnataka, the chairman of the Nuclear Power Board, Mr S. L. Kutty, said the cost of nuclear energy per unit will be much cheaper than thermal energy by 1990. [Text] [51004700c Delhi Domestic Service in English 0830 GMT 4 Oct 87] /9274

NUCLEAR POWER CORPORATION--The Nuclear Power Board is being converted into Nuclear Power Corporation from today with an authorized capital of 2,000 crore rupees. Disclosing this in Bombay, the chairman of the Atomic Energy Commission, Dr M. R. Srinivasan, said the new corporation will be responsible for design, construction, and operation of nuclear power stations in the country. [Text] [51004703 Delhi Domestic Service in English 0240 GMT 16 Oct 87] /9274

NORWAY BID FOR HEAVY WATER SUPERVISION DENIED

51004501 Jerusalem Domestic Service in Hebrew 2100 GMT 3 Oct 87

[Text] Israel has rejected a Norwegian request that would enable international supervision over the heavy water Norway supplied to Israel 27 years ago. According to the Oslo Foreign Ministry spokesman, Israel rejected the request to transfer the heavy water to the International Atomic Energy Agency, whose headquarters is in Vienna, saying that this commission is one- sided in its political stand against Israel. A Norwegian delegation that had been discussing the future of the heavy water left Israel at the end of the week. Norway fears Israel is using the heavy water for the production of nuclear weapons.

/9274

ZIA ON NUCLEAR ISSUE, RELATIONS WITH U.S.

51004700a Karachi Domestic Service in Urdu 1500 GMT 27 Sep 87

[Excerpt] President Mohammad Ziaul Haq said that Pakistan's foreign policy is based on principles that are in the best interests of the country. Talking to newsmen on his arrival in Quetta for a day's visit, he said the aforementioned policy, which has been formulated by the government under the leadership of Prime Minister Mohammad Khan Junejo, is aimed at safeguarding and promoting national interests. He said Pakistan adopted a policy on Afghanistan 8 years ago when the Afghan problem arose. The elected government has reviewed and found this policy to be in the country's interests and, therefore, has followed it consistently.

The president emphasized that the international policy on nuclear nonproliferation should be applied to all countries and that Pakistan alone should not be made the target of attack for using nuclear technology for solely peaceful purposes.

The president expressed the hope that the Gulf conflict will be resolved peacefully with the efforts of the United Nations and the cooperation of the superpowers.

About Pakistan's relations with the United States, the president made it clear that their relationship is not tied to Pakistan's aid requirements, as these are two different things. In the afternoon, the president inaugurated the Baluchistan Week celebrations of the Frontier Corps.

/9274

U.S. INCONSISTENCIES IN NUCLEAR AID POLICY CHARGED

51004701 Lahore THE PAKISTAN TIMES in English: 28 Sep 87 pp 4-5

[Article by Iqbal S. Hussain]

[Text]

Pakistan's frequent 'nuclear explosions', not anywhere in Pakistan, but on the pages of American and European newspapers have at last led to temporary suspension of the U.S. aid to Pakistan or so it is recommended by a Congressional Committee.

The suspension has been attributed to Pakistan's alleged involvement in the 'dirty nuclear business.' Though there is no tangible evidence to establish Pakistan's actual manufacture of nuclear weapons, but mere suspicions and allegations have produced a situation which could generate changes in Islamabad's foreign policy.

The people and government of Pakistan are naturally very bitter on being penalised for a crime which they have not committed, while the real culprits (India and Israel) continue to enjoy the US blessings despite their actual explosions and concrete programmes to develop nuclear arsenals. India exploded its first nuclear device in 1974, and still it remains a major recipient of advanced computerised electronics and essential requisites. It has been importing heavy water and other raw materials illegally from West Germany and the Soviet Union. But no country condemns India and it continues to receive substantial financial and technical aid from all the donor countries.

Pakistan despite its best assurances remains the main target of foreign attacks. 'Islamic bomb in-the-making' is the universal cry, while the world continues to wink at 'Hindu' and 'Jewish' bombs.

The current crises in Pak-US relations appears to have erupted as a result of the arrest of a Canadian of Pakistani origin who is alleged to have been involved in the export of special quality steel to Pakistan. The arrest was made despite the fact that the Canadian Arshad Pervez was issued a licence from the US Department of Commerce. The case from the very start appears to be a trap since the allegation of bribing the customs official is frivolous.

Moreover there is no proof that the material involved was to be used only for the manufacture of atom bombs and not for a dozen other peaceful purposes. Also the US Customs official Warren has said that so far there was no evidence in their possession to link the Pakistan Government with the case under investigation.

From the very start the case seems to be concocted merely to harm the US-Pakistan ties. There is strong pro-India lobby in the United States which spares no effort or occasion to damage Pakistan's position vis-a-vis the US. The trap appears to have been prepared by elements opposed to the cordial Pak-US relations and have been trying hard to have the US aid to Pakistan stopped.

The termination of the US aid to Pakistan will have major consequences for Pakistan-US relations. Pakistan can, however, and should live without such assistance, as it has been able to do so in 1965, 1978 and 1981. Though Pakistan's ambassador to Washington has assured the United States government that a possible cut in the US aid might not lead to a change in Pakistan's foreign and Afghan policies, but the mood of the nation will eventually tilt the scales in other direction. Moreover, its impact on the fragile domestic structure which is now being developed on democratic lines might also be unhealthy.

Coming back to the nuclear issue, it is clear that Pakistan cannot exist in a void. In a region threatened by superpower conflicts, India's hostile designs and nuclear ambitions, Pakistan cannot remain impervious and a silent spectator to developments around itself. Having been invaded thrice by India since its birth in 1947, Pakistan has learnt bitter lessons. Through India's military intervention it has been deprived of East Pakistan. Delhi has never really recognised Pakistan's existence and continues to try to destabilise the country by exploiting several avenues at the same time. World-wide anti-Pakistan campaigns through western media constitute one of their means. Pro-India lobbies such as in the United States act

highly effectively to damage Pakistan's position.

Militarily India has developed its conventional forces manifold and has reached at the same time an advanced stage of nuclear technology. With the aid of Western industrialised nations and the USSR, India has received nuclear technology, reactors and essential raw materials. Recently a West German film revealed India's secret network to smuggle heavy water from West Germany and the Soviet Union. India has

[sentence as published]

We have never had a desire to go for nuclear weapons or a bomb either in the past or in the future. All of us salute the Prime Minister for translating the thoughts of the entire nation, when he announced to the Pakistani community in New York that we do not believe underground or underhand methodology. When we say we do not wish to make an A-bomb, we mean it. But if required it would not be secret.

Thank you Mr. Prime Minister for summarising a complex situation in a simple sentence. Mr. Mohammad Khan Junejo has thrown the ball, spun by the Yashad case conspiracy, back into the American court. For the past four decades, ever since our Independence, Pakistan has remained committed to honour the common values we share with the United States. Through thick and thin, we have never faltered in our resolve to abide by the fundamental principles of our foreign policy laid down by our Founding Father — the Quaid-i-Azam. The U.S.A. on its part, however, has always chosen to sacrifice its friendship with this country at the altar of expedience and short-term local gains. In a nut-shell, the United States has everytime deserted Pakistan in a moment of crisis and flirted with India to woo and win her over, to its side or at least neutralise her leanings towards the Soviet Union. India has never failed to exploit this display of love from Washington and even black-mail the U.S. on this score. We have no desire to desert the United States, but the history of U.S. desertion of its friends is no secret. The suspension of pledged aid to Pakistan is the latest illustration of this non-credibility non-consistency in U.S. foreign policy. Pakistan has faced this situation with grace, dignity and confidence. The Prime Minister's visit to New York and meetings with President Ronald Reagan and other U.S. officials is perhaps the last opportunity for the American people to retain or lose the future friendship of the people of Pakistan. The Pakistani people have no desire to be taken for granted, and our elected Prime Minister has, in no uncertain terms, left no doubt in the American mind on this score.

/9274

COMMENTARY ALLEGES SHIFT IN U.S. NUCLEAR POLICY

Islamabad THE MUSLIM in English 29 Oct 87 pp 4-5

[Article by Abbas Rashid]

[Text] The Indian Prime Minister Rajiv Gandhi has, apparently, had a successful meeting with the U.S. president Ronald Reagan in Washington where he stopped en route from the Commonwealth conference in Vancouver. On top of his agenda was the issue of Pakistan's nuclear capability.

Commending the U.S. Congress for its aid cut off to Pakistan in a manner completely shorn completely of diplomatic finesse and devoid of even a superficial concession to the much touted principle of non interference he said we are glad that recently the U.S. Congress put limitations on aid that will flow to Pakistan unless Pakistan makes some clarifications about its programme to manufacture nuclear arms. We hope that these clarifications will be concrete and meaningful and will not be merely a show to make an excuse for the resumption of aid to Pakistan. In other words--well done; but watch out for the wily Pakistanis. As for his own demands in this context, he made it clear that what was required from Pakistan was a "demonstrable proven commitment to abjuring nuclear weapons."

P.R. Skill

It is a tribute to India's consummate skill at public relationing that it continues to occupy the moral high ground on the nuclear issue despite its own major advances in this area and its utter disregard of various proposals, most of them made by Pakistan, to rid South Asia of nuclear weapons, including the one made by the Prime Minsiter of Pakistan from the floor of the United Nations. In this he said that both India and Pakistan should simultaneously sign the nuclear non-proliferation treaty. That India has successfully exploded a nuclear device, euphemistically (or hypocritically) termed as peaceful, as far back as 1974 is conveniently relegated to the background in the midst of a veritable hysteria over the possibility of Pakistan acquiring nuclear weapons generated by India from a holier-than-thou vantage position.

It should be kept in mind that the latest Indian initiative in this connection is particularly well timed to coincide with a high point in concern among U.S. foreign policy making circles amenable to the Israeli argument that U.S. interests in the region are best safeguarded with the nuclear monopoly in the area remaining with Israel on the issue of Pakistan acquiring nuclear capability, now that many believe that it is actually possible for it to do so in the near future.

Concern

In recent months, not only has this concern been conveyed to Islamabad publicly through the former U.S. ambassador to Pakistan Dean Hinton and more diplomatically by the U.S. Under Secretary of State Michael Armacost when he visited Pakistan earlier this year but the U.S. Senate also saw fit to pass a resolution in July 1987 (an identical one was approved by the U.S. House of Representatives in August) which reiterated the U.S. desire to maintain a long term security partnership with Pakistan. It proceeded to point out that "the greatest threat to this partnership arises from activities in Pakistan's nuclear programme that are viewed as being inconsistent with a purely peaceful programme. Further, the resolution urges Pakistan to "eliminate this threat" and suggests that doing so would serve our mutual interests in promoting stability in South Asia and assisting the Afghan people."

In other words, Pakistan should abjure nuclear weapons (which it is supposed to be in the process of manufacturing) for the dubious privilege of continuing to serve as a conduit and staging area for one of the largest covert C.I.A. operations since World War II. That the Afghans are, in fact, waging a desperate struggle to regain their independence cannot mean much in terms of the ethical principles that supposedly inform U.S. foreign policy for, after all, so too are the Palestinians whose oppressor Israel, has consistently been the recipient of U.S. largesse.

In any case, Rajiv's current tour of the United States has come at a time when there appears to be considerable pressure from within the U.S. Congress to force Pakistan into a position of unambiguously renouncing its nuclear option Rajiv may not be far from being wrong when he speaks of a "shift" in U.S. policy with regard to the Pakistan--India equation.

Admittedly, President Reagan after his meeting with the Indian Prime Minister urged both Pakistan and India to jointly resolve the nuclear issue, formally indicating an even handed approach. In substance however, it is abundantly clear that while the U.S. has practically accepted India's nuclear status (just as it has accepted, and abetted, a nuclear Israel) it seeks to ensure that Pakistan does not acquire such a capability.

To that extent Rajiv Gandhi was probably right again when he said towards the end of his tour that the United States will act against Pakistan if the latter makes an atom bomb. Indeed that seems to be the bottom line as far as the U.S. is concerned. Starting with the "horrible example" that was made of

Zulfiqar Ali Bhutto on this issue followed by the pressurising of an ostensibly sovereign French government to cancel its deal with Pakistan for the supply of a reprocessing plant and the currently suspended U.S. aid—all reflect on the substance of U.S. policy in this regard.

Free Hand

India, on the other hand, far from being subjected to such pressure, has been allowed a free hand. An illustration of the U.S. response to Pakistan's argument that it would be willing to forego its nuclear option only on a reciprocal basis with India is provided by Senator Bill Bradley's statement, just a few weeks before the Indian Prime Minister's visit, in the Congressional Record, on the Senate resolution on Pakistan (and India) nuclear issue. Dilating on Pakistan's activities that appear geared to a nuclear weapons programme, Senator Bradley in effect calls on Pakistan not only to desist but to do so regardless of the course of action adopted by India: in the past Pakistan has justified these activities by invoking India's example. It is true that India's nuclear activities raise similar suspicions and pose similar dangers. India's stock piling of unsafeguarded nuclear materials is a serious concern. And those of us who are committed to the goals of non-proliferation are deeply disturbed by, and critical of, India's activity in this area. India's explosion in 1974 and subsequent stockpiling of unsafeguarded nuclear material have increased political pressures on Pakistan to seek a nuclear deterrent. Few would argue that it has been a serious mistake for India to have gone this route. It is unfortunate that India's leaders cannot see this, but it would be tragic if Pakistan repeated India's errors. One should learn from the mistakes of others not emulate them. And were Pakistanis to attempt to match India's capabilities to produce or deploy nuclear weapons; the costs to all of us including Pakistan, would be very high."

While Mr. Bradley, speaking for a powerful lobby in the U.S. Congress makes himself abundantly clear when in effect telling Pakistan to do what the U.S. thinks is in its best interests, he is somewhat less than enlightening when he says, for instance, that India made a serious mistake in going this route.

It certainly does not seem to have been penalised for this mistake—not even by the United States. If anything, in recent months, there has been a considerable warming up of relationships between the two countries. In September, last year it was reported that the U.S. government had approved the sale of the General Electric company F-404 jet engine to India. Since the suspension of U.S. military aid to India in 1965 (during the Indo-Pakistan war) this was the first major military agreement between India and the U.S.A. Subsequently, Caspar Weinberger went to India in what was the first visit to that country by a U.S. Secretary of Defence. More recently negotiations have been finalised on the procurement of an highly advanced U.S. Cray/XAMP/ "supercomputer," 24 (or equivalent) ostensibly, for use in weather forecasting but potentially capable of being used in nuclear weapons development.

Recognition

It is obvious, then that the U.S. is entirely committed to weaning away India from the ambit of the Soviet Union and has clearly indicated its recognition (in many ways and on more than one occasion) of the country as the paramount power in South Asia. The lack of agreement between the two on exactly how to treat Pakistan is a temporary phenomenon and does not alter the essential contours of the emerging relationship.

The U.S. regards Pakistan's role in the Afghanistan war as being extremely useful in the context of its larger strategic designs. It is, therefore, reluctant to accommodate the Indian demands entirely with respect to "putting Pakistan in its place." Accordingly, even on the issue of Pakistan's nuclear capability, its approach has been to soft peddle in view of the Afghanistan angle. Nevertheless, the pro Israel lobby in Congress has gradually managed to assert its views, if not entirely prevail, against continuing aid to Pakistan.

Once the Afghanistan issue is resolved, however, there would be very little to detract from the convergence between U.S. and Indian perceptions on Pakistan and the nature of the latter's (subsidiary) role in the region. About this Pakistan's policymakers should not harbour any illusions. It is a measure of the very slight difference in the positions of the two countries in this regard that despite Pakistan continuing role in the context of Afghanistan, the U.S. Congress has gone ahead and suspended aid to Pakistan. It is also an indication of the extent of the latter's complete dependence in being unable to receive an assured quid pro quo for its role in promoting U.S. interests in the region.

Rajiv's visit to the U.S. has served to put the finishing touches on a new U.S.-India relationship that has been in the process of being hammered out for some time now. A major snag in the proceedings, so far, has been India's reservations on the supply of advanced U.S. weapons to Pakistan. To India's satisfaction, three factors may have led the U.S. to take a harder line toward Pakistan: a) The increased pressure from within the Congress against Pakistan's nuclear programme; b) Pakistan's abject state of dependence on U.S. aid and c) Pakistan's ambivalent response to the proposal that it play a central role in U.S. naval operations in the Persian Gulf.

It is in this context that Pakistan should review its own foreign policy options. If nothing else, it should take a leaf from India's book and attempt a more even-handed approach in its relationship with the two superpowers. The present juncture provides Pakistan with a tremendous, and rare, opportunity. The only question is whether its rulers have the wisdom or the will to avail of it.

08309
CSO: 51004708

PRESIDENT RESTATES POLICY ON NUCLEAR ENERGY

Rejects Pressure To End Nuclear Program

51004702 Karachi Domestic Service in Urdu 1500 GMT 19 Oct 87

[Excerpt] President Mohammad Ziaul Haq says that Pakistan will not be pressured, threatened, or tempted to give up its program of the peaceful use of atomic energy, and opposes the use of this energy for destructive purposes. He made these remarks during a speech at the inauguration of a compressor station at the Sui gas field today, which was built at a cost of more than 2 billion rupees.

He noted that Pakistan has several times proposed that the United Nations declare South Asia a nuclear free zone. We are also prepared to sign the Nuclear Nonproliferation Treaty, provided India also does so.

The president reiterated that Pakistan will use atomic energy for the benefit and welfare of humanity. He said: We have to concentrate on conventional sources of energy, especially oil and gas, until an alternative source of energy has been discovered. [passage omitted on government's plan for developing energy resources]

Affirms Need for Energy Program

BK200248 Hong Kong AFP in English 0210 GMT 20 Oct 87

[Text] Karachi, Pakistan, Oct 19 (AFP)—President Mohammad Ziaul Haq said Monday Pakistan would not renounce the peaceful use of nuclear energy under any kind of pressure, intimidation or temptation.

Inaugurating a gas compressor station at the Sui gas field 60 kilometres (37 miles) north of here, he said: "We urgently require nuclear energy so that our factories and machines may keep on operating."

"Our fields abound in green crops, our people may be healthy and energetic and our towns and villages are lit up with electricity," he said. "In other words, we shall utilise nuclear energy wholely and only for the benefit and welfare of mankind."

"We do not know why our friends are afflicted by far-fetched mistrust and apprehensions from our efforts and successes in this field," he said.

"The truth of the matter is that Pakistan has been declaring...that we are, both in theory and practice, opposed to the destructive use of nuclear energy."

Referring to recent U.S. criticism of Pakistan's nuclear programme, the president recalled his government's proposals made at the United Nations that South Asia be declared a nuclear free zone. "This is our standing proposal, which we have repeatedly reiterated," he said.

"We earnestly desire to conclude a treaty with India for the mutual inspection of each other's nuclear installations. We are even willing to sign the nuclear non-proliferation treaty if India also does so."

/9274

JUNEJO PROMISES TO ACCELERATE NUCLEAR DEVELOPMENT

Islamabad THE MUSLIM in English 26 Oct 87 pp 1, 8

[Text] KOT ADDU, Oct 25: Prime Minister Mohammad Khan Junejo, today said it was imperative for Pakistan to acquire and utilise most modern technology for electric generation, particularly in the field of nuclear power production.

The Prime Minister was speaking at the inauguration of a 400 megawatt thermal power plant constructed at a cost of Rs.271 crore at Kot Adu nearly 90 kilometres from Multan. The inaugural ceremony was attended among others by the Punjab Governor, Makhdoom Mohammad Sajjad Hussain Oureshi, the Chief Minister, Nawaz Sharif, Federal Minister for Water and Power, Kazi Abdul Majid Abid, members of the National and the Punjab Assembly. The Ambassadors of Federal Germany and Italy, the two countries, which had helped in the completion of the project with a foreign exchange credit amounting to Rs. 1410 million and by providing technical services, were also present.

The Prime Minister said there was shortage of fuel resources in Pakistan and the only way to overcome the persistent power load shedding was to employ the latest technology to augment power generation. He said the whole world knew that the most important and ultra modern method of producing electricity was through the utilisation of nuclear energy.

The Prime Minister said Pakistan expected the friendly countries to help in updating the quality of technology available here for the production of electricity, particularly in the field of nuclear energy.

The Prime Minister said it was impossible to plan social well being of the people and to aim at improving the quality of life without substantially increasing the production of electricity. This was true not only in case of Pakistan, but all the countries the world.

Stressing the importance of establishing more thermal facilities for power generation, the Prime Minister said, production of the hydel power stations was uncertain because of low levels of dam reservoirs during the winter months, a period during which the need for electricity was most.

The Prime Minister said the elected Muslim League government had framed its economic policies in the light of the national needs and requirements of the people. He said his five point development programme had laid special stress on the uplift of the rural areas.

The Prime Minister said no progress could be achieved only by formulating plans. What was important was that these plans should be implemented with a sincerity of purpose.

The Prime Minister said in his view any progress which benefitted only a section of the people was useless. The present government, he said, believed that development activity should benefit every citizen of the State and it was because of this reason that stress on rural development was natural and obvious. Nearly 70 per cent of the population lived in villages, and the industrial efficiency also depended largely on agricultural produce. He said being a truly domestic government he felt that the door to prosperity and progress should be opened to all. As such he was determined that 90 per cent of villages of the country should be provided facility of electricity by 1990. The new power house at Kot Addu, he said, would go a long way to meet this objective.

The Prime Minister said Pakistan was a country with limited income and resources, as such it was imperative that expenses on the import of goods should be curtailed and the country's own natural resources were developed to the maximum.

He said that God Almighty had been kind to Pakistan because there was no dearth of specialists and natural resources. The whole nation was imbued with a spirit to achieve progress and the common people had the unmatching qualities of toughness, diligence, and valour besides having a fully developed sense of direction and proportion.

Prime Minister Junejo said no work was impossible for a nation gifted with these qualities. As such his government had decided that to develop the basic and important sector of power generation, it would resort to all possible avenues and would overcome every hurdle on the way.

The Prime Minister said the commissioning of the Kot Addu gas turbine power station was an important step towards the fulfillment of the promises made by the present government for accelerating the pace of development and solving the energy crisis.

He stressed the importance of producing more electricity, which was needed for industrial expansion, to make large tracts of barren land fertile by installing more tubewells and to create new opportunities for the people by providing them with the basic facilities of energy and water.

He also referred to the lakhs of acres of agricultural tracts in the Punjab and Sind which had been rendered waste because of the twin menace of water logging and salinity. He said since agriculture was the base of the national economy, it was important to reclaim salined and water logged land so as to increase agricultural production, which had a direct bearing on it.

The Prime Minister said the menace of water logging and salinity could be overcome only through a crash programme, the successful implementation of which depended entirely on the ample availability of electricity.

The Prime Minister said besides electricity, different types of oils were also needed for the crash programme to eradicate water logging and salinity. The indigenous production of diesel and petrol was only 42,000 barrels per day, with the result that Pakistan had to spend crores of rupees to import diesel every year. The country was also spending a large amount in foreign exchange on the import of goods needed for development purposes. It was important that these expenses were cut down with the full utilisation of the national resources, particularly through the production of electricity.

Later the Prime Minister inaugurated the power house by pressing a button, which instantly put an extra 400 megawatts on the national grid. The Prime Minister also went round the big power house where he was enthusiastically welcomed by the power house workers, who also showered flower petals on him. The power house had been colourfully decorated with bunting and large banners inscribed with welcome slogans.

WAPDA LOSSES: Later Mr. Junejo directed the WAPDA authorities to cut power losses in the country to the bare minimum limits.

He said strict vigil be kept on power losses and the regional engineers be made responsible to monitor the power losses. "We need power for national development and as such power losses be curtailed," he observed.

The Prime Minister was informed that power losses stood at 25.6 per cent including transmission losses of 9.6 per cent while theft and technical losses accounted for 15 per cent. He was also informed about the steps being taken by WAPDA to minimise power losses.

The P.M. was informed that some loadshedding would have to be done in January next. There would be shortfall of about 600 megawatts due to lean water period in January.

About the development work the Prime Minister was told that on an average 22 kilometre long electric wires were erected per day in the past one year.

08309
CSO: 51004707

JUNEJO ASSERTS PAKISTAN TO ACQUIRE NUCLEAR TECH 'AT ANY COST'

Karachi DAWN in English 26 Oct 87 pp 1, 3

[Text] Multan, Oct 25: Prime Minister Mohammad Khan Junejo has said Pakistan has decided to acquire nuclear technology at any cost.

Speaking at the inaugural ceremony of 400 megawatt gas turbine power station at Kot Addu on Sunday morning, the Prime Minister said that nuclear technology was vital for the progress and prosperity of Pakistan and he urged the friendly countries to help Pakistan in acquiring it.

The Prime Minister also stressed the need for launching a crash programme to combat the twin menaces of water-logging and salinity and added that non-availability of irrigation water was the main hurdle in bringing the land under the plough and this shortage could not be met by installing tubewells.

He said that Pakistan was spending a huge amount on the import of diesel oil, though domestic production of oil had increased to 42,000 barrels per day which was one third of the domestic demand. While stressing the need for exploring the natural resources to meet the national requirements, he said that at present 60 per cent of total generating capability of WAPDA system was [word indistinct] and the remaining 40 per cent thermal-hydel power generating system entirely depending upon the water resrvoirs.

Earlier, Qazi Abdul Majeed Abid, Federal Minister for Water and Power said that WAPDA was producing 6500 megawatt electricity and its generating capacity would increase to 8495 megawatt during the sixth five-year plan.

The minister said that consumption of power would increase to 7221 megawatts till 1990 and 9400 megawatts till June 1993 and added that we would be able to get rid of load-shedding till 1990.

The Chairman of WAPDA, Lt. Gen Zahid Ali Akbar Khan said that WAPDA had worked out plans for coming up with series of thermal power units. The first was inaugurated at Guddu in April 1986 and the other today in Kotaddu which was completed in 23 months.

He said that WAPDA had planned to instal 23 more thermal units at Guddu, Kot Addu, Jamshoro, Faisalabad, Kotri, Lekhara and Multan.

In addition, the Karachi Electric Supply Corporation has planned to add three units of 210 megawatts, each during this period, he said.

LOCAL POLLS: Prime Minister Mohammad Khan Junejo said on Sunday that the Government had finalized the schedule for Local bodies elections which would be announced shortly.

Mr Junejo said that the ninth constitutional amendment bill would be tabled at the next session of Parliament depending on the load of business of the House.

He ruled out any delay in Local Bodies elections. The Prime Minister who is also President of Muslim League said he saw no possibility of any alliance with any political party in Local Bodies elections which would be held on non-party basis.

The Prime Minister also said that India had no right to walk into Siachen. However, he added, demarcation of the area was yet to be carried out. He said Pakistan was quite capable of retaliating against aggression.

Replying to a question about reports of a Soviet offer of assistance, Mr Junejo said that the Government had not received any formal offer of financial aid and it would respond only when such an offer was made. President Reagan had assured him that United States would not stop or suspend the aid of Pakistan.

He said that there was no danger of war and our borders were safe.

The Punjab Chief Minister Mian Nawaz Sharif, Punjab Governor Makhdoom Sajjad Hussain Qureshi, Federal Minister for Water and Power Qazi Abdul Majeed Abid, Chairman WAPDA, Lt Gen Zahid Ali Akbar Khan and provincial Minister Mian Ghulam Hasker Wyne also accompanied him.

Prime Minister Mohammad Khan Junejo has announced one month bonus for the workers of gas turbine power station of Kot Addu and praised their efficiency in completion of this power station.

/8309
CSO: 51004706

SPOKESMAN REITERATES STANCE ON NUCLEAR ISSUE

51004700b Karachi Domestic Service in Urdu 1500 GMT 30 Sep 87

[Text] A Foreign Office spokesman in Islamabad today reaffirmed Pakistan's commitment to the peaceful use of nuclear energy and its willingness to join efforts aimed at declaring South Asia a nuclear-free zone. The spokesman made this statement while commenting on the U.S. Government's alleged insistence that Pakistan sign the Nuclear Nonproliferation Treaty and allow inspection of its nuclear installations. He added that there has been no change in Pakistan's policy in this regard.

Answering a question on the extent to which Pakistan is affected by the Gulf situation, the spokesman said that Pakistan has very friendly relations and mutual cooperation with countries in this region. Pakistan's trade with these countries amounts to over 20 percent of its total trade, and hundreds of thousands of Pakistanis are working there.

Commenting on the alleged statement by the Kabul regime's foreign minister that the next round of Geneva proximity talks will [words indistinct] the spokesman expressed the hope that the issue of a (?timetable) for the withdrawal of foreign troops from Afghanistan will be resolved during this round of talks.

Referring to the issue of the Wular barrage [being constructed by India in Kashmir], the spokesman said that Pakistan and India have agreed to hold official talks on the matter. A 2-day meeting between the delegations of the two countries will begin in Islamabad on Sunday [4 October]. The Government of Pakistan hopes that the issue will be resolved bilaterally and in a friendly manner in accordance with the Sind Basin Treaty.

/9274

COMMENTARY ALLEGES INDIAN NUCLEAR 'TRAPS'

Islamabad THE MUSLIM in English 24 Oct 87 pp 4-5

[Article by Pervaiz Iqbal Cheema]

[Text]

One of the intriguing features of international relations in the twentieth century has been the ability of countries, rich in cultural heritage but inexperienced and young in politics and diplomacy, to influence the dominant global powers out of proportion to their own advantage. India is one such country that has acquired this uncanny ability to influence both the Soviet Union as well as the United States simultaneously. With pronounced poverty of cultural and historical heritage, the US compared to the Soviet Union is regarded as an easy prey. India has demonstrated during the last forty years of its independent career that it can effectively lay traps for the Americans. The Americans believing in fairplay and even-handedness, are so naive and so easily out-manoeuvred and trapped that they do not even get time to realise what has happened. One such trapping venture is currently well underway.

NUCLEAR ISSUE

Ostensibly Rajiv had gone to participate in a regular but ritualistic conference of the Commonwealth countries held at Vancouver. On the way to Canada and back he visited the US twice. Having anticipated angry demonstrations of Sikhs living abroad and expecting provocative, perceptive and penetrating questions regarding complex domestic situations and ongoing developments in peripheral areas, the Indian leader decided to leave Delhi with a well-planned strategy of diplomatic offensive. Naturally they chose Pakistan as the target primarily because of the known and continuous antagonistic relations would not only act as a smoke-screen but would also divert attention from the hidden but real long term Indian objectives. The nuclear issue was chosen as the tactical pursuit as maligning of Pakistan's nuclear programme goes down well among some Americans these days. Despite the fact that Pakistan has repeatedly assured the Americans that it has no intentions of becoming a nuclear weapon state, these Americans appear to be more inclined to believe Indian interpretation of Pakistan's nuclear programme not because they are genuinely convinced of India's truthfulness but merely because it lends support to their own policy pursuits within the context of their domestic political scene. Rajiv, during the last few days, has been repeatedly asserting that since Pakistan is treading the forbidden path, therefore, its aid should be completely stopped. In fact, he has openly suggested that efforts should be directed to close down Pakistan's nuclear programme and in this connection, if it is deemed necessary, to discontinue the American aid altogether. It should be promptly done.

INDIA'S STRATEGY

What is perhaps strange and somewhat painful is that some influential Americans and many Indians appear to generate the image that there exists a congruity of views on the nuclear issue between the Rajiv's interpretations of Pakistan's nuclear programme and the Americans. Accordingly both are vociferously recommending the termination of aid. Linked with this tactical move is India's drumming of the notion that if Pakistan wants to make a bomb, it should go ahead and make it irrespective of the wishes of its friends or regional dictates. The strategy appears to be is to encourage Pakistan to make the bomb through non-governmental agencies and sources at regional level while simultaneously maligning Pakistan's peaceful nuclear programme and influencing Pakistan's friends to stop aid altogether through official sources at global level. Officially India could not afford to encourage Pakistan to make the bomb (although this is precisely what she wants) primarily because Pakistan had scored so much diplomatically on varied offers to cage the nuclear monster that were not accepted by India. Official words of encouragement to Pakistan in this pursuit would obviously reveal India's real intentions and future designs and may even openly convict her much before the time they have decided to announce publicly the desired status of a nuclear weapon state.

An eminent American official once expressed that he regarded non-alignment not only as something immoral but also as standing on the fence with both hands open towards opposite directions ready to grab anything that comes even from diametrically opposite directions. The current policies of India are no different. Ostensibly contradictory objectives are pronounced and requisite policies are outlined, one objective is to be pushed

through unofficial agencies while the other through the official channels. Invariably neither of the announced policies contain the real objectives but the pronounced and the declared policy pursuits often, if successfully executed, bring the additional bonus.

During the current trip, Rajiv's declared objectives are to secure the transfer of sophisticated technology (directly or indirectly) and to buy supercomputers from the Americans and to try to stop the American aid to Pakistan. He seems to have been fairly successful in these pursuits. At least this is the impression he has given to the waiting pressmen after his latest two-hour long meeting with President Reagan. Gandhi categorically stated that he saw a definite shift in US policy towards Islamabad. By concentrating too loudly on the above mentioned declared objectives, he has managed, once again, to divert attention from his real objectives which are to carry on with its own extensive and comprehensive nuclear programme with a complete nuclear fuel cycle, to divert attention from domestic as well as regional developments.

PAK N. AMBIGUITY

What the Americans failed to comprehend is the fact that Pakistan's nuclear ambiguity is making Indians restless and uncomfortable. They want Pakistan to openly admit that she has opted for the bomb as such a confession would enormously facilitate India's pressing desire to openly become a nuclear weapon state. Unable to secure this objective, they are now pursuing the policy to secure a total stoppage of aid which would compel Pakistan to alter its policies relating to Afghanistan. Such a move would prove extremely advantageous to the Soviets for which some share of credit would come to India. Being a regional and friendly power, enhanced Soviet prestige and influence could indeed be useful in realising India's own designs in the area. Alternatively Pakistan would react angrily to aid stoppage and the Indians hoped that it may openly commit to nuclear path which in turn would facilitate Indian designs. Besides securing aid stoppage or even causing substantial cut would go down very well with the Indians. Unfortunately for the Indians, the Pakistanis have played their cards rather carefully and have asserted that the aid stoppage may cause some changes in its Afghan policy but it would not be able to even modify the adopted policies relating to peaceful nuclear developments in Pakistan. Realising the implications of calculated Pakistani moves, India has now begun to generate the impression that Pakistan has already made the bomb and India can no longer afford to remain without the desired weapons.

INDIA'S NEGATIVISM

To divert attention from the incumbent awesome magnitude of domestic violence by using external diversion is not an uncommon pursuit of the Indian decision-makers. A simple glance at the last forty years of Indo-Pak relations clearly depict that Pakistan factor is perhaps the most useful instrument for diversion from ugly realities of the domestic Indian scene. Confronted with ongoing problems of Assam, Gorkhaland, communalism, Khalistan, corruption and desertion of Congress Party members, the need for diversion providing the requisite respite is quite comprehensible. Most Pakistanis understand that in such difficult circumstances the Indians are likely to place disproportionately large share of blame on them. What is perhaps most incredible and intriguing is the employment of Pakistan factor by India for shaping American South Asian policy. The arrogant display of India's patronising and instructive attitude not only reflected easy attainment of its objectives but also made pointed references to the poverty and hollowness of American South Asian policies. For most Pakistanis, it was obvious that Rajiv, during his recent tour of US, would try his best to whip up anti-Pakistan feelings and further malign Pakistan's image by excessively dwelling on the nuclear issue. Cognisant of the fact that some influential Americans are already convinced that Pakistan is engaged in bomb pursuit, Rajiv aimed to put the Americans on the defensive by sermonising and projecting the non-existent link between the aid and Pakistan's peaceful nuclear programme. As expected, the Americans fell easy prey to the Indian leader's trap. His negativism seems to be appreciated by some Americans. Not much has been discussed about why India is arming itself with a complete fuel cycle. Why none of the Pakistani proposals for containing the emerging nuclear monster of South Asia has been given due respect? Why the sale of computers and transfer of technology could not be made conditional and linked with some type of South Asian non-proliferation treaty which may not be a permanent device?

Many South Asian states have been at the receiving end of India's arrogance and negativism for the last four decades, but the successful extension of Indian brand of negativism to powers like US is a new development. Dictating aspects of India's desired policy in South Asia is not unknown phenomenon but suggesting to superpowers how to conduct their South Asia policy is reflective of the new confidence India has acquired recently. India's successful juggling of superpowers artlessness with simpleton traps is certainly commendable. Undoubtedly Rajiv's recent trip was a success in the sense that he went to the US with twin objectives of buying computers and securing sophisticated technology accompanied by efforts to deny aid to Pakistan, and has nearly attained both of them. Gorbachev while visiting Pakistan's major adversary India, avoided quite cleverly all unnecessary references to Pakistan, whereas Rajiv visiting Pakistan's friend US, managed to dictate to the Americans what should be their Pakistan policy with almost complete immunity. What good friends we have?

An American official said that the opportunity to improve relations with Delhi came at a time when Washington's relations with Islamabad were not only under strains but were growing more fractious. The underlying assumption seems that such opportunity could not be easily allowed to bypass. This is precisely the Rajiv trap. He knows it well that currently US-Pakistan relations are experiencing difficulties and to capitalise over such a state of affairs he has been repeatedly asserting that India wants more balanced relations with superpowers. Unable to comprehend the young Indian leader's moves but extremely impressed by India's cultural heritage the Americans have begun to see a shift in Indian policy. Rajiv sees a shift in America's Pakistan policy and the Americans see a shift in India's linkage with a great power. Which shift is going to be earlier not only remains to be seen but the degree the eventual rearrangement of relationship would be heavily dependent upon it.

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NUCLEAR POWER SURPLUS, COSTS, FUTURE PLANS DISCUSSED

Paris LE MONDE in French 30 Sep 87 pp 1, 43

[Interview with Pierre Delaporte, president of the EDF, by Veronique Maurus; date and place not given]

[Text] While public opinion, shocked by Chernobyl, is less and less favorably inclined to nuclear power, EDF officials, for reasons of economy, are keeping their distance from the atom. Pierre Delaporte, president of the establishment for the past 4 months, explained, in the interview he granted us, that he wants to slow down the speed of orders for nuclear power plants to the maximum extent. He does not rule out the possibility of "agonizing reappraisals" with respect to breeders such as Superphenix if they do not prove their profitability. He also believes that there must be a reduction in EDF personnel for the first time in 15 years.

[Question] For the first time this summer, the EDF shut down a nuclear power plant for economic rather than technical reasons. Is the excess capacity foreseen by 1990 already making itself felt?

[Answer] The EDF has always shut down a number of power plants in the summertime because our installed power, even though perfectly adapted to winter demand, is in excess of summer consumption, which is much lower. Some 75 percent of our electricity is now from nuclear sources. We shall therefore have to shut down our nuclear divisions more and more frequently in the summertime. You cannot conclude from this fact that "overequipment," a word I detest, is already evident.

[Question] Which term do you prefer? Advance?

[Answer] Yes, or reserve capacity.

[Question] How great is it, in your estimation?

[Answer] At the present time, we have just what we need. Remember that it was so long ago that this agency looked to the winter with dread!

Could we be equipped above and beyond the economic optimum for 1990? Yes. By how much? That depends on the growth projections for consumption, but one

could put that "advance" at about five stages. This means that we could have done without five nuclear reactors for a few years, while continuing to use old coal or oil plants that we are going to convert.

We have therefore gone beyond the economic optimum, but it is not a crisis. The corresponding surcost will not exceed 2 percent on rates for a few years, while the startup of the nuclear program brought us infinitely greater economic benefit. If you take the example of our industrial clientele, it enjoyed an optimum relative drop in prices of 20 percent, which will actually be temporarily reduced to 18 percent. This means that we have taken ten steps forward and one back.

[Question] You are in the class situation of the industrialist who had somewhat grandiose projections.

[Answer] Somewhat, yes. That can be easily explained. First of all, in the energy field, it is infinitely more harmful to estimate low than high. Consequently, it is obvious that it is better to plan somewhat big. Furthermore, our power plants have the best availability in the world. Our old calculations were aimed at doing as well as the Americans, meaning build power plants capable of operating 60 percent of the time throughout the year. We have reached 80 percent. That is also what gives us a look of "abundance." We are a bit "fat."

[Question] What are your conclusions about the rate of orders for power plants? In 1987 and 1988, a single phase was planned, with one plant at Chooz and another at Civaux. Will you have to slow down even more?

[Answer] We shall try to "trim down" a bit more. But it is not our energy needs that dictate speed of commitment, but rather, the critical speed for the French nuclear industry. One could theoretically calculate an ideal rhythm for the EDF: no order for 3 or 4 years, then a phase and a half a year, followed by two phases a year. But that is not realistic. We cannot ask manufacturers to go from four or five phases a year to nothing, then start off again with two, and so on. We shall have to trim down, but without putting French industry in a decline. Otherwise, like a plane, it will risk stalling. It is not easy, but we have already gone down to a very slow pace.

[Question] Can you consider "jumping" 1988?

[Answer] From the energy standpoint, yes. From the industrial standpoint, we shall see. For several years, we would like to maintain as slow a pace as possible, but one compatible with the survival of our nuclear industry.

[Question] Superphenix is encountering serious difficulties. Under such conditions, do you believe it is necessary to order a second breeder? On what economic terms?

[Answer] The alternative of the breeders is still of great interest, but we are not in a hurry. The prospect of a shortage of uranium has moved considerably further into the future, well beyond 30 years, which removes much of the benefit and urgency from this alternative.

For the time being, fast neutron reactors (meaning breeders) are far from achieving the economic performance we had hoped for and we must take advantage of the time we have to improve on that. We must tell our research teams to go back to the drawing board for 3, 4 or even 5 years, if necessary, learning what they can from what we have, and then draft a program making it possible to bring the fast reactors, if not in line with the economic level of the pressurized water method, then at least very close to it. This would enable us to move to an industrial scale in 19, 15 or 20 years.

[Question] By how much would we have to reduce costs?

[Answer] By half, which is not impossible. The cost of the photovoltaic cells has been reduced to 1/20th. Superphenix is a prototype, a phase, the first on an industrial scale, but there will be others. However, we must have reasonable hope of producing a power plant that is economicallyviable, meaning only a bit more expensive than the conventional nuclear plant.

[Question] And if not?

[Answer] Then we might be forced into an agonizing reappraisal, if our teams come back in 5 years and tell us: "It is impossible. This method will always be 50 percent, 80 percent or twice as expensive as what we are now doing," then we shall perhaps have to alter our plans. It would be heartbreaking because our world lead in the field is a promise of victories ahead.

Outdated Slogan

[Question] Is the EDF's wager of "all-nuclear power" not somewhat dangerous today? Do you not expect to look at other energy sources such as coal in order to diversify the risk?

[Answer] We are already doing that. All-nuclear power is a somewhat provocative and outdated slogan. Moreover, water power performs very well and in the long run, we shall build new projects. We are already thinking about what coal plants will be like by the year 2000. It is essential that they be clean because public opinion on this matter of pollution will only grow stronger. However, we are not worried. It is not a priority, but yet we are looking at it closely.

[Question] The great period of construction is over. We must now manage our nuclear plants in order to obtain electricity at the lowest possible cost. Will you rechannel personnel, investments and even commercial policy along those lines?

[Answer] We have gone to a ceiling of six plants ordered in a year and will now drop much lower.

Personnel will obviously be affected, but it is a situation we can manage. EDF personnel had been stable for 2 years, after being greatly inflated between 1981 and 1982 when they went to 38 hours. The number of employees will drop nearly everywhere and for different reasons. In the plant construction sector,

this will be obvious. Moreover, it will be the effect of progress in productivity. We shall have a "paperless" civilization and some trades may even disappear. Naturally, there can be no question of going back on life-long contracts. There will be no layoffs. We shall merely use the natural departures. We shall permit wage earners to receive additional training in order to have a new trade. The EDF has done so for a long time. We shall perhaps have to shift into a higher gear on this.

As to managing our nuclear production plants, we still have technical progress margins totaling in the billions. The nuclear industry is still young. We have to be cautious and above all, maintain the level of safety.

[Question] What about investments? Last year, there were serious breakdowns. The EDF promised to give priority to distribution.

[Answer] The major quick reduction in plant construction programs should enable us to reduce our investment program on the whole and achieve a partial transfer to systems.

As far as the quality of the product is concerned, we are not yet at the level we should be for a country such as France. We are not as good as our larger neighbors. Service quality is disturbing for our industrial clientele, especially and small and medium-size businesses and industries, which do not have the means to buy a thyratron inverter making it possible for them to have perfect current. Furthermore, they are increasingly computerized, which makes the effect of interruptions more and more difficult to handle. Our goal consists in being in a very good competitive position in Europe within the next 10 years.

[Question] Will that priority to industrial customers also be reflected in rates? Can we say that after a good fight with Pechiney and the Ministry of Industry, you have buried the hatchet?

[Answer] You could say so. In big industry, the vast majority of the enterprises do not attach particular importance to electricity, which accounts for only 1 to 1.5 percent of their costs. But for others, electricity is almost a matter of life and death, a very important element of their cost prices. For them, we have to make an extra effort. For too long, we have made "one size fits all." We succeeded with Pechiney, then Atochem. Now we must do so with all the customers for which electricity plays an important or very important role. To do so, we must speak out. We have preconceived ideas concerning their needs, just as they do concerning our rigid rates. We must put all information on the table and work in a spirit of complete partnership. I am convinced that we can find solutions which, without overwhelming either of the two enterprises in question, will nevertheless be satisfactory and profitable for both sides.

Quality

[Question] What about quality of service for the average customer?

[Answer] It can improve, especially in the region of Paris, which certainly sets no example! That is one of our prime objectives. The goal of quality is now the very backbone of our plans. Naturally, it cannot simply be dictated, but we can create a different spirit. We can mobilize young people and fans. While there may remain a hard core of recalcitrants, they can always be made to feel ashamed!

[Question] You recently hinted in L'AGEFI that after 2 years of profits, EDF books would again show red ink this year. Are we to conclude that the EDF is doomed to lose money, except in the case of exceptional circumstances, such as a drop in the price of the dollar, coal and oil?

[Answer] This year, there should be a balanced result, at about 200 million francs, but it is true that we run a great risk of going in the red again. That is a problem of rates. The company met all the commitments made in its contract and then some. It has improved its results. The draft contract provided for a drop in the cost price of 3 percent a year. For the past 3 years, we have done better, on the order of 3.5 percent a year. The different with our good results of 1985 and 1986 has to do with the fact that instead of increasing rates by 1.5 points as planned on 15 February, we had to reduce our prices for the third consecutive time. The effect of this latter measure compared with what we expected exceeds 2.5 billion francs. Nor should one be surprised.

The government wanted consumers to enjoy, not only all the exceptional events (mainly the drop in the dollar), but also, all the establishment's management efforts. As a result, we have dropped back down to 0 and getting out of debt will have to come in the future!

[Question] How burdensome is that debt?

[Answer] We are, in absolute terms, France's enterprise most heavily in debt: 220 billion francs, a substantial sum.

Finance charges make up 20 percent of that debt, a fifth of the cost price. We want to reduce that debt as soon as possible, but unfortunately, it will not be soon. We have not yet hit our peak. Courageous measures must be taken right away, but the debt will not go down before 1990. We will make our contribution to the fight against inflation, but when they take away all the windfalls that occur only once, along with the company's efforts to provide customers with short-term benefits, this without allowing a single franc to go toward paying the debt, seems to me to be excessive. Proof of this is that we shall end the year starting from scratch. That is not a wise policy, even for our customers. If they continue to play these tricks on us, we will no longer be able to keep our commitment of a rate increase limited to 1 point below inflation and finance charges will take an even larger share of our budget.

[Question] What do you hope for for next year?

[Answer] The draft contract, nothing more. We can even forget the past, by and large.

Nuclear Consensus

In the end, the "Chernobyl effect" will have done with the notorious French "nuclear consensus." A poll conducted in May by CREDOC (1) and published by the Ministry of Industry confirms it: For the first time since the beginning of the decade, there are now more French people hostile to the development of nuclear electricity (49 percent) than for it (48 percent), with those uncertain making up only 3 percent.

This is a complete reversal which, beginning last year just after the disaster (26 April 1986), has intensified since that time. While from 1981 to 1985, the number of positive votes steadily increased, going from 58 to 67 percent, they numbered only 51 percent in October 1986 and have dropped more since that time (48 percent in May 1987).

At the same time, the opinion poll shows growing concern about a possible accident (49 percent of all French people concerned in May, compared with 33 percent in 1985), revealing an absolute lack of trust in authorities in the case of a catastrophe. Some 63 percent of the persons questioned believe that "the authorities would not be ready to assume responsibility for protecting the people," with the least trusting being farmers (72 percent) and retired people (65 percent), contrasting with those under the age of 25 and students 56 and 55 percent concerned).

Finally, one last element reveals the crisis of confidence of the French regarding electric power plants: the price of electricity, which they now fear may increase over the next 5 years (38 percent), while up until 1985, oil products were the pet peeve!

FOOTNOTES

1. This survey was conducted in May 1987 among 2,000 persons representing the French population 18 and older. It was completed by CREDOC (Research Center for the Study and Observation of Living Conditions) for the Ministry of Industry, the French Energy Control Agency and the EDF.

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DETAILS OF NUCLEAR SPACE GENERATOR STUDIES REVEALED

51002402 Paris REVUE GENERALE NUCLEAIRE in French May-Jun 87 pp 288-295

[Article by Claude Poher, Program Director, CNES, and Jean Delaplace, IRDI-Nucleaire, CEA]

[Text] Since 1982 the CNES [National Space Studies Center] and the CEA [Atomic Energy Commission] have been conducting joint studies on nuclear space generators. The power of these generators is greater than the power of the solar generators that are now used to provide an energy supply for satellites, and they are expected to undergo a major development early in the next century. The studies done by the CNES and the CEA involve a reference generator called ERATO. The authors describe its characteristics and its major components as well as the technical problems involved in its development; however, there is no question about the feasibility of this project.

Introduction

As part of their preparation for future long-term space missions, the CNES and the CEA have been conducting studies of nuclear space generators since 1982.

It has long been known that these generators are the most suitable for providing electricity over 100 kilowatts for satellites; they can operate for several years without maintenance (Figure 1).

A brief study of a nuclear generator was actually done at the CEA about 20 years ago (Figure 2). It showed that the capacity of the launch vehicles at that time was by no means sufficient to place such generators into orbit (1.5 to 1.8 tons for 80 kWe).

The electricity for today's satellites is provided by photovoltaic solar generators with powers under 10 kWe. Major advances in microelectronics and signal processing have made it possible to handle more and more numerous and complex functions without needing greater amounts of electricity.

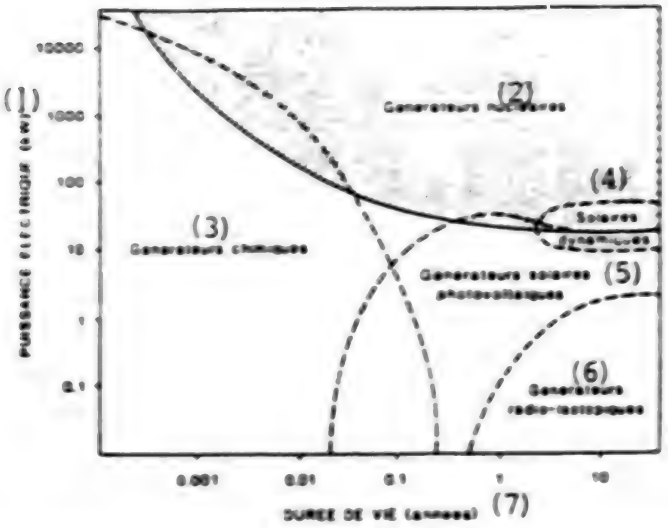

Figure 1: Ranges of utilization of different types of space generators, showing their power and duration of operation.

Key:

1. Electrical power (kW)
2. Nuclear generators
3. Chemical generators
4. Solar dynamic generators
5. Photovoltaic solar generators
6. Radioisotope generators
7. Lifespan (years)

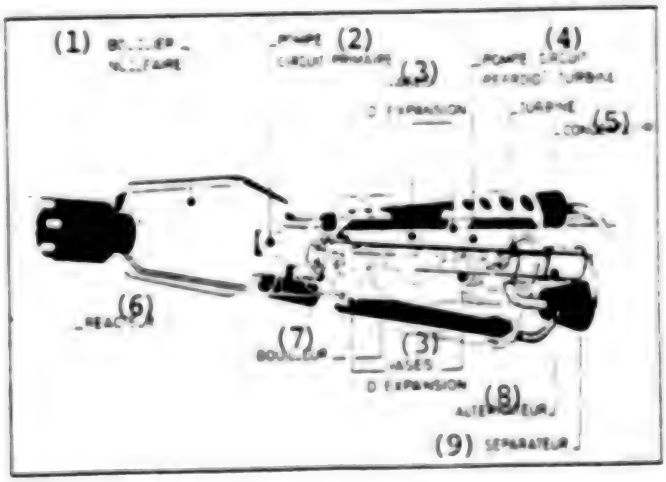

Figure 2: Nuclear space generator studied by the CEA in 1965

Key:

1. Nuclear shield
2. Primary circuit pump
3. Expansion vessels

4. Turbine cooling circuit pump
5. Condenser
6. Reactor
7. Boiler
8. Alternator
9. Separator

However, as the capacity of the European launch vehicles is continuing to increase, this is opening up prospects for new applications which will certainly be introduced before the end of this century. Starting in 1995 the Ariane V launch vehicle will enable Europe to place in orbit nuclear space generators with an electrical power much higher than the power of today's solar generators. At that time very high energy-consuming missions which had until that point been impossible will become feasible.

The CNES believes that high-power space electricity generators will come to occupy a very important position right after the start of the 21st century.

The ERATO Studies

For this reason, the CNES and the CEA have once again resumed their studies of nuclear space generators. These studies are being conducted by a joint working group composed of about 20 people, most of whom are working part-time on this project.

A reference generator has been defined in order to undertake these studies in a concrete manner. The technical specifications for this study were based on a hypothetical space mission: the power supply for the electrical propulsion system of an interorbital transfer vehicle. The generator studied was named ERATO [Atomic Inter-Orbital Transfer Vehicle] (Figure 3).

It was determined that the mission of an electrical-propulsion vehicle for the transfer of commercial payloads between orbits represents (for the electrical generator) a broad range of the technical difficulties which may be encountered in the majority of the future missions which may use nuclear generators.

In fact, the range of electrical power considered for ERATO extends from 50 to 400 kilowatts; the generator's mass has to be minimal; the standards to be met to protect payloads from radiation from the nuclear reactor are quite stringent; and respecting nuclear safety criteria will be severely tested with a generator that is continually changing orbits.

Quite obviously, the selection of a reference mission like the one for this orbital tranfer vehicle does not mean that this mission will be the first to use high-power generators in the future, or even that it will ever be done. In fact, many other high-energy consuming space missions will probably be candidates for the use of generators with powers exceeding 100 kWe. Such potential missions are, for example:

a. Power supply for the European space station
b. Large civilian and military orbital radars
c. Infrared observation using cooled optics
d. Automatic space probe using electrical propulsion to explore distant planets, etc.

All these missions will be the subject of indepth studies at the appropriate time. The ERATO studies are only intended to analyze the design of electrical generators sufficiently standardized so they can be used for all these missions, if possible.

Results of Feasibility Studies Completed in 1985

The first phase of the study of the detailed characteristics of nuclear generators, the evaluation of their technical feasibility, the determination of the plan for and of the cost of their development, undertaken by the CNES and the CEA starting in 1982, were completed by the end of 1985. The major conclusions of these studies follow:

a. The mass of these generators will be two to three times less than the mass of solar generators of the same power. The space they occupy will be approximately 20 times smaller; this will produce major savings in the propellants needed to keep on station large satellites placed in a low orbit (space stations) using such generators.

b. Their recurrent cost will be approximately 10 times less than that of solar generators of the same power.

c. The development costs of the nuclear space generator system, roughly equivalent to the purchase price of a 200 kWe solar generator, will be amortizable starting with the first generators used.

d. Nuclear space generators will have an exceptional resistance to external aggressions of all types. This will make them particularly valuable for future military applications in space.

e. Their feasibility does not entail any insurmountable technological problems; however, the need to use very high temperature technologies (1,200°C) will require a very long development plan: 15 to 20 years.

f. The skills now existing in France in the space and nuclear fields (in both government organizations and in industry) could make France the European leader if the decision to begin the development of such generators were made quickly.

g. Nuclear safety questions related to the use of these generators in space have been examined with great care. Many technical options may be used to render the risks of their utilization as low as the risks of nuclear technology on earth. These options may be given full-scale testing on the ground in order to demonstrate their validity in a convincing manner.

Continuation of the Work

In early 1986 the CEA and the CNES decided to continue these studies in order to prepare for the actual development of high power generators.

The armed forces participated in examining the results of the feasibility study and a program is now underway to study possible versions of generators suitable formilitary purposes beyond the year 2000.

The program during the 1986-1989 period entails technological studies concentrating mainly on the high-temperature materials which are essential for the development of the reference system.

These studies will be financed in equal shares by the CNES and the CEA, as has been done in the past.

By beginning laboratory testing of critical technologies right now, based on a sufficiently prudent approach, the objective of a first launch of generators of this type toward the 2005-2010 time frame may be maintained.

At the same time the working group is also considering in depth other generator concepts suitable for different space missions; this will open up the possibility of making a choice after 1989.

The results obtained between now and 1989 will help in eventually determining the start of the following phase of the program, which would then become a specific development project, and of tests of components and subsystems for a generator with precise specifications.

Cooperation among several European states appears desirable in order to carry out such a program at the same time as many other ambitious space projects. This cooperation is being sought both by the CNES and by the CEA, and the armed forces officials are also much in favor of it. In fact, the first military missions feasible for this field will probably be observation satellites equipped with radars. These are highly advanced and expensive systems which would probably be more within the reach of Europe than of a single nation.

With this in mind, preliminary talks with interested countries are now in progress. The results of these first contacts are highly encouraging.

The mass of the complete unit, not optimized, is close to 7 tons.

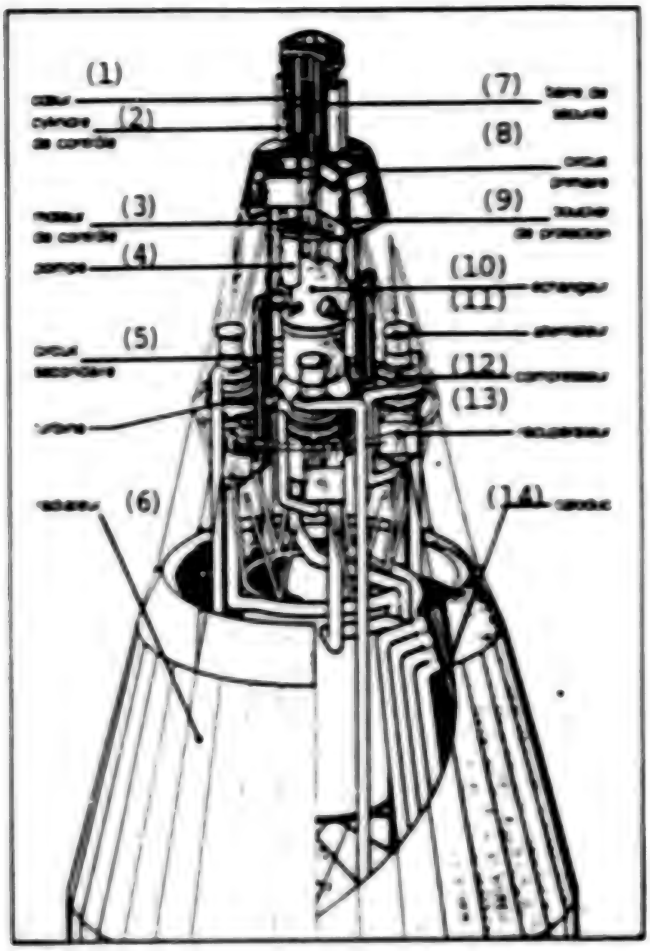

Figure 4: Internal view of the ERATO 200 kWe nuclear space generator.

Key:

1. Core
2. Control cylinder
3. Control motor
4. Pump
5. Secondary circuit
6. Radiator
7. Safety rod
8. Primary circuit
9. Protective shield
10. Exchanger
11. Alternator
12. Compressor
13. Extractor
14. Heat pipe

Description of the ERATO 200 kWe Reference Generator

A nuclear space generator operates according to the same principles as a power plant on earth: a dynamic conversion system (gas or steam turbine) or a static system (thermoelectric or thermoionic) operates between a hot source, consisting of the reactor, and a cold source. However, the constraints inherent in space require operation in a zero-gravity environment and a cold source that must be formed of a radiator radiating in space. The need to limit the surface of this radiator demands high operating temperatures requiring the use of special materials.

The system's specifications--nominal electrical power of 200 kWe, 7 year life without maintenance, radiator surface limited to 140 m^2, and minimal mass--determined the general outlines for the study of the nuclear space generator concept. This work has made it possible to select a coherent set of technical options, to evaluate the feasibility of the technologies considered, to determine the preliminary dimensions of the system, and to estimate the costs and development schedules of such a generator. This led to the birth of the ERATO "reference system."

The definition of this system is based either on tested data, or on realistic extrapolations, but the definitive choices will only be made after an examination of different types of solutions or simply of improvements for each subsystem. In particular, a reduction in the specific mass (kg/kWe) will be sought, along with the adaptation of this system to other space missions.

The ERATO 200 kWe reference system includes essentially (Figure 4):

a. A fast neutron nuclear reactor whose core consists of needles containing highly enriched uranium (93%) in the form of UO_2 (or of UN), cooled by circulating lithium at 1,200°C (see References 1 and 2).

b. A conversion system composed of four turbomachines each with a gas turbine, a compressor, a heat exchanger-extractor, operating in a closed circuit Brayton cycle (References 3 and 4).

c. A 140 m^2 radiator with approximately 300 heat pipes (Reference 5).

d. A shield to protect sensitive materials from radiations emanating from the reactor.

e. A generator management system to provide command and control of the reactor, regulation of the conversion system, monitoring of the subsystems, etc.

f. A structure to house the various components and subsystems.

The Nuclear Reactor

Operating within a fairly broad range of power, the fast neutron reactor cooled by circulating liquid lithium offers several advantages:

a. Good capacity, providing a favorable specific mass;

b. Good thermal inertia due to the liquid metal, which is of value during transient stages;

c. Low pressure operating with a relatively low core T.

Moreover, this reactor concept adapts well to different conversion systems.

Using lithium does mean, though, that some specific problems must be resolved:

a. Launch with lithium in a solid metal state since the reactor will be launched unused;

b. Melting of the lithium before the increase in power. This calls for a number of specialized systems, including an auxiliary startup electrical power supply.

c. Volumic expansion of lithium up to 1,200°C;

d. Separation of the helium produced by nuclear reaction with the residual Li_6, despite the use of 99% Li_7 enriched lithium.

e. Behavior of the materials in the presence of liquid lithium.

The ERATO reactor's thermal power is 1.1 MW for an electrical power of 200 kW of electrical power, but a reactor of approximately the same size could deliver much greater power.

The reactor's core (Figure 5) is a cylinder whose diameter and height are both 320 mm. The fuel being considered is either uranium nitride, UN, or uranium dioxide, UO_2. The UO_2, though, could create some problems of compatibility in the presence of liquid lithium, in case of a break in the cladding material. The cladding material is a molybdenum-rhenium alloy. The reactor vessel and the primary circuit are made of the same material.

A lateral neutron reflector made of beryllium oxide, BeO, surrounds the reactor vessel. It has 12 grooves in the form of passageways in which 12 control cylinders are placed (Figure 6). These each include an absorbent sector made of boron carbide, B_4C, enriched to 90 percent in boron 10. The rotation of the cylinders driven by pitched motors enables the reactivity to be controled. When the absorbent sectors are turned toward the core, the counter-reactivity reserve is 5,000 pcm.

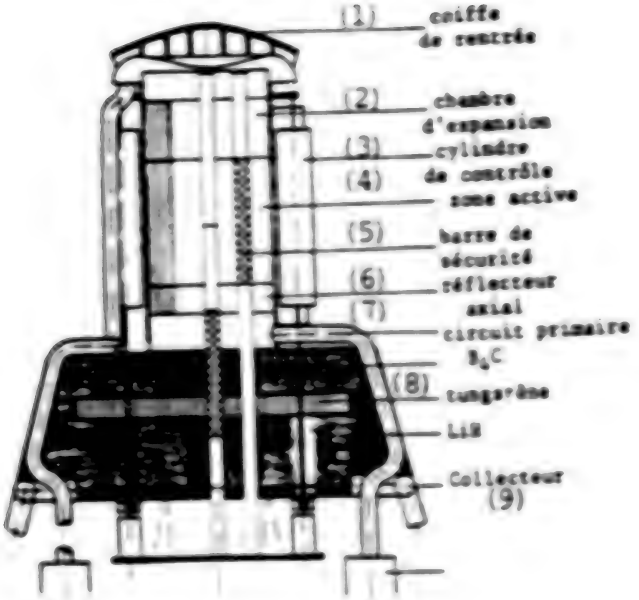

Figure 5: ERATO: Internal view of the reactor and the protective shield.

Key:

1. Re-entry cone
2. Expansion chamber
3. Control cylinder
4. Active zone
5. Safety rod
6. Axial reflector
7. Primary circuit
8. Tungsten
9. Collector

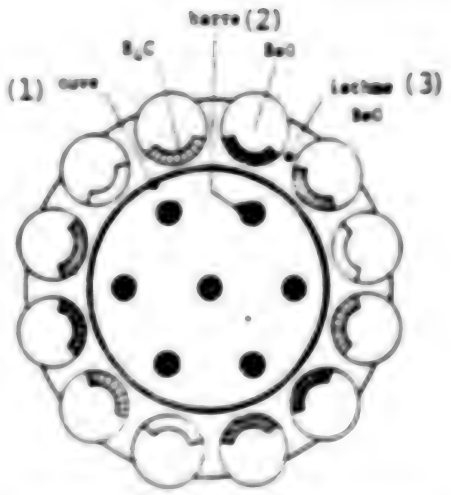

Figure 6: ERATO: Transversal view of the core. Arrangement of control cylinders and safety rods inside the core.

Key:

1. Vessel
2. Rod
3. Passageway (isthmus)

Seven safety rods made of B_4C kept in the core until the moment when the reactor goes critical provide an additional counter-reactivity reserve of 5,000 pcm. This averts any danger of the reactor going critical in case of its immersion after a launch failure and a fall into the ocean. Each safety rod has a guide spindle made of BeO which prevents the ejection of the rods forward in case of a frontal impact, and in normal operation reduces neutron leaks through the channels passing through the core.

At the top of the reactor is a small thermal protection shield to maintain the core's integrity in the event of an accidental impact on the ground at the time of launch. This maintains the containment of the fissile material.

Neutron Protection Shield

Within a solid limit angle the shield provides protection against the neutrons and gamma photons for the sensitive materials carried on board (electrical and electronic equipment, payload). The presence of astronauts on board is not being considered for the currently conceptualized space missions.

For the electronic equipment located approximately 12 meters from the reactor, the following maximum levels have been set for integrated doses over a 7-year period:

a. 10^{13} n/cm^2 in neutrons of energy greater than 1 MVe;
b. 5.10^{15} rad in gamma photons.

The shield is made of different materials placed in successive layers:

a. Boron carbide (100 mm thick) to absorb thermal neutrons;

b. Tungsten (55 mm) to absorb gamma photons

c. Lithium hydride (205 mm) which first slows and then absorbs the fast neutrons;

d. Austenitic steel to maintain the mechanical properties of the entire unit.

The Primary Circuit

The primary circuit (Figure 7) circulates lithium between the reactor vessel and a lithium-gas exchanger. It has two loops, each with an electromagnetic pump, without any valves to improve reliability. The lithium-gas exchanger, called the intermediate exchanger, is used to transfer the heat transported by the lithium to the gas of the energy conversion system. It has over 300 exchange tubes traversed by gas and bathed in liquid lithium, distributed in four clusters, each of which is part of a secondary loop. One of the ends of

the exchanger has a bellows which handles variations in the lithium volume, from its melting point (180°C) up to 1,200°C, the temperature of the lithium at its output from the reactor.

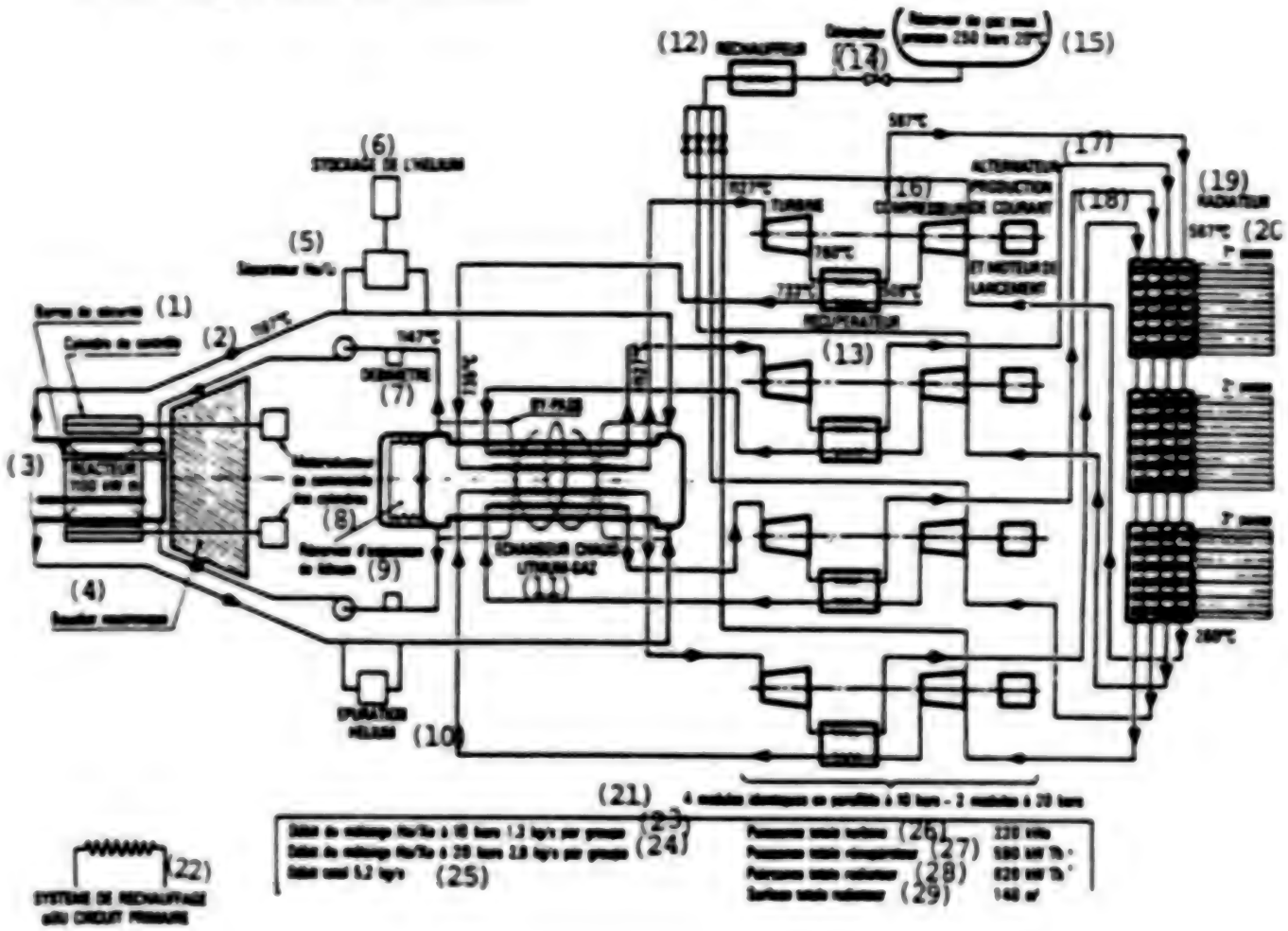

Figure 7: Theoretical schematic of the entire ERATO system.

Key:

1. Safety rods
2. Control cylinder
3. 1100 kW thermal reactor
4. Neutron shield
5. He/Li separator
6. Helium storage
7. Flowmeter
8. Cylinder command gear motor
9. Lithium expansion tank
10. Helium purification
11. Hot lithium-gas exchanger

12. Heater
13. Extractor
14. Reducing valve
15. Pressurized gas tank (250 bars, 20°C)
16. Compressor
17. Alternator
18. Current production and startup motor
19. Radiator
20. pass
21. Four identical modules in parallel at 10 bars--two modules at 20 bars
22. Primary circuit's heating system
23. Flow of the He/Xe mixture at 10 bars, 1.3 kg/s per group
24. Flow of the He/Xe mixture at 20 bars, 2.6 kg/s per group
25. Total flow, 5.2 kg/s
26. Total turbine pressure
27. Total extractor pressure
28. Total radiator pressure
29. Total radiator surface

Each of the two primary loops has an exchanger surrounding circuit, a coil wrapped around the external wall of the exchanger, under the heat insulation. This coil traversed by hot lithium coming from the core helps to liquefy the lithium contained in the body of the exchanger during the first startup of the system.

Electromagnetic pumps were chosen rather than thermal pumps which operate without an electrical power supply, but which cause ongoing problems with the use of magnets at high temperatures.

A continuous lithium purification system uses heat traps to eliminate corrosion products from the circuit, and separates the helium produced by neutron reactions with lithium.

The entire circuit is covered with a thermal insulant composed of approximately 60 sheets of a heat-resistant metal 10 m [sic] thick, separated by zirconium grains.

Energy Conversion System

Thermal energy is converted into electrical energy by four turbomachines which each have a turbine, an alternator, and a compressor along the same axis. The gas, an He-Xe mixture, works in a closed circuit thermal Brayton cycle, with an extractor (Figure 8).

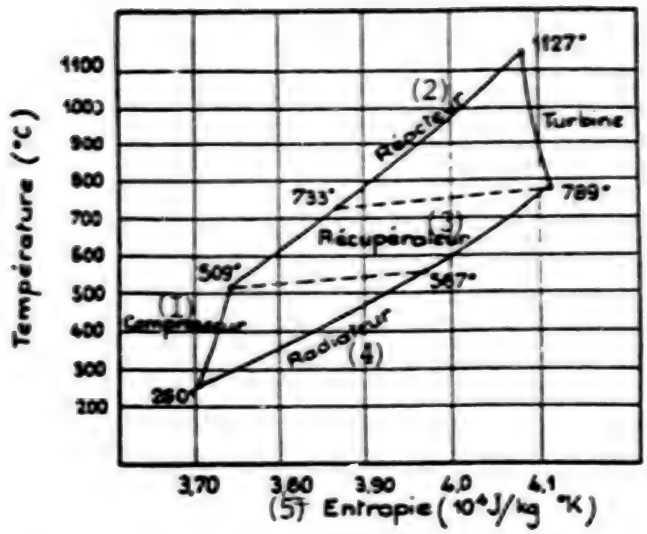

Figure 8: Brayton Cycle with extractor used in ERATO.

Key:

1. Compressor
2. Reactor
3. Extractor
4. Radiator
5. Entropy

The turboalternator groups are derived directly from the ones used in aeronautics. The high conversion efficiency, 21 percent, limits the power to be removed by the radiator and the entire system provides a gain in mass in relation to static systems: thermoelements or thermoionic diodes. However, the high operating temperatures demand the use of special materials. Careful investigation has shown that their development and use are possible with a reasonable amount of effort. The balance seemed favorable, and this explains the choice that was made.

In nominal generator operation, the four machines designed for 100 kWe each supply 4 x 40 kWe; in this way, if one group is not working, the nominal power of 200 kWe can be maintained with two counter-rotating groups, by doubling the pressure of the secondary circuit. A pressurized gas tank, used to compensate for possible leaks form the circuit, makes this operation possible.

The hottest parts of the secondary circuit are made of a tantalum alloy (ASTAR 811 C). Hastelloy X and Inconel X 625 are being considered for sections which are less hot. The shaft common to the turbine, the compressor, and the alternator rotates on gas bearings with metal blades, bathed in the working gas. The unwound rotor alternator provides a power of 55 kWe in threephase

current of 115/200 volts at 2,500 Hz; it is used as a motor driven by an auxiliary power source to start the turbomachine. The rotation speed is 50,000 rpm.

The entire circuit is insulated from heat by an insulant similar to what is used in the primary circuit.

Cold Source. Principal Radiator

The power source radiates into space the power that is not converted into electrical energy--approximately 800 kWth. Ariane V can handle a radiator of 180 m^2, of which 140 m^2 are used for the principal radiator. The option currently being considered is a radiator with 300 heat pipes, in order to provide satisfactory redundancy to cope with the risk of breakage of one of the pipes by a small meteorite.

The temperatures (250 to 550°C) and the thermal performances required (2 to 3.5 kW/heat pipe) correspond to the performances of heat pipes of the mercury-steel type. Such heat pipes have a diameter of 18 mm, and each pipe has a soldered beryllium blade, which acts as a radiating surface and provides protection from meteorites.

Startup and Operation

The startup procedure consists of several sequences:

a. The reactor begins to go critical when the desired orbit has been reached; the generator is monitored by telemetry--power almost zero.

b. The lithium is melted at a power of 10 thermal kW for approximately 3 hours.

c. There is a gradual rise in power and successive startup of the four turbomachines.

There are plans to keep the reactor operating at constant power--equal to its nominal power--during the 7 years of its life, with the electrical power that is not used being dissipated.

When nominal power has been reached, the regulation system maintains stability by using measurements of neutron power, flows and temperature, making use of the control cylinders. The sequential management of these cylinders arranged in four groups of three provides a differential efficiency in the rotation of the cylinders, as it remains constant throughout the reactor's entire life.

The detection of anomalies in the system's components, or the drift of parameters working against the functioning diagram or of the protection diagram, causes one of two actions, conducted by the control cylinders:

a. A rapid decline in power, stabilized at a reduced level compatible with the system's safety in its weakened condition. If possible, a new configuration is defined, so that power can be restored to its intermediate level, or even to its nominal value; this action is the responsibility of the ground control center.

b. Emergency shutdown by rapid insertion of all the control absorbents in their most effective position. After a shutdown, the later restoration of power may necessitate an energy source to melt the lithium (if the shutdown lasted that long), to start the primary pumps or to start up the turbomachines. The auxiliary power source on board is designed to be able to handle a limited number of such startups.

Any escape of lithium, gas leak from the secondary circuit into the primary circuit, or rapid drop in pressure in the secondary circuit triggers an automatic reduction in power, and then the reactor's shutdown.

The residual power at shutdown may be evacuated passively. Thermal conduction of the lithium and radiation from the lateral surface of the non-insulated vessel provide a sufficient transfer of heat from the core into space.

The major features of the ERATO system are shown in Table 1.

Table 1: Major Characteristics of the ERATO System

Reactor		480 kg
Thermal power		1,100 kW
Uranium mass (93 percent U_{235})		113 kg
Fuel rods		1,050
UO_2 or UN O pellet		6.9 mm
Fissile column	H:	320 mm
Mo-Re cladding (25% at)	O:	7-8 mm
Lower axial reflector BeO		70 mm
Total height		575 mm

Heat conveyor		Li
Flow		5.4 kg/s
Calculated pressure		2 bars
Core intake temperature		1,147°C
Core outlet temperature		1,197°C
Primary circuit		500 kg
Lithium loops		2
1 electromagnetic pump per loop		2.7 kg/s
1 lithium-gas exchanger		330 exchange tubes
Gas temperature at exchanger outlet		1,127°C
Gas temperature at exchanger intake		733°C
Total mass		7,000 kg (approximately)
Overall dimensions		
Length		17 m
Diameter		4.6 m
Control cylinder		12
Be	O:	95 mm
B_4C sector		120°C
Thickness		20 mm
Safety rods		7
B_4C	O:	33 mm
Mo-Re cladding	H:	320 mm
Protective shield		950 kg
B_4C	thickness:	100 mm
W	thickness:	55 mm
LiH	thickness:	205 mm
Principal radiator		1,800 kg
140 m^2 beryllium	thickness:	3 mm
input temperature		567°C
outlet temperature		260°C
power evacuated		820 kWth
328 stainless steel-mercury heat pipes		

Conversion systems	1,290 kg
4 He-Xe gas loops	
4 turbomachines, Brayton cycle with extractor	
4 alternators	50,000 rpm
pressure	10 bars
gas-loop flow	1.3 kg/s
turbine intake temperature	1,127°C
turbine outlet temperature	789°C
extractor outlet temperature	567°C
radiator return temperature	260°C
compressor outlet temperature	509°C

ERATO's Nuclear Safety

The safety of using a nuclear reactor in space has been taken into consideration since the first design studies.

Like what is done in nuclear facilities located on earth, the radiological protection of the environment must be guaranteed in both normal operation and in an accidental situation. The rule is to prevent any dissemination of radioactive matter in space.

One of the special features of the nuclear space generator is the diversity of the environments which have to be protected during the various phases of the reactor's life:

a. During assembly of the reactor in an assembly shop on the ground;

b. During transport of the reactor to the launch pad;

c. During its placement on the launch vehicle, and during launch preparation operations;

d. During launch, during the ballistic phase, and placement in orbit;

e. During startup of the reactor and operation in orbit;

f. After final shutdown, in orbit, and during final reentry into the atmosphere (after several hundred years).

For each stage, possible accident scenarios have to be inventoried and the safety criteria must be ascertained. A systematic analysis will then determine the measures to be taken during design, as well as the procedures to be applied for each case.

In addition to these specifically safety-related considerations. there is also the problem of recovering the fissile material (about 100 kilograms of 93 percent enriched uranium) in the event of a launch failure, as the point of reentry into the atmosphere can not be controled in every circumstance.

The Reactor Before It Goes Critical

The reactor is launched unused and it will only become critical when the nuclear generator has reached the planned orbit. So there are no special radiation protection problems in relation to the reactor, whose fissile material is 93 percent enriched uranium. The only safety criterion to be met from the time of fabrication until its placement in orbit is the absence of critical conditions in case of immersion (an accident during transport, a fall into the sea after a launch failure, etc) or of compaction of the core (a fall from the launch pad, fire or explosion at the time of launch, fall into the sea from a high altitude, etc).

The immersion scenario imagined led to planning for a set of seven absorbent safety rods (B_4C) bolted into position until startup of the reactor in orbit. In the launch configuration, the 12 control cylinders are locked into place, with the absorbent sectors facing the core and the safety rods placed inside the core. So in the event of a failure at the time of launch and a fall into water, a sub-critical protection level of 5,000 pcm is provided, based on the following hypothesis:

a. The reactor's geometry is maintained, but the lithium is replaced by water;

b. The lateral reflector is ejected and it too is replaced by water.

In the event of compaction, having the reactor designed to be of a suitable size will help to avert any accidents involving criticality. In addition to a theoretical analysis of possible deformations, experiments will be needed to compare the core's real compaction configuration to the deformations calculated.

If the reactor should fall into a foreign country after a failed attempt to place it in orbit, there will be a problem of recovering the fissile material, in order to avoid any danger of diversion of the 100 kilograms of enriched uranium. Two options are possible, and no decision has yet been reached between them: either to seek the maximum containment of the fissile material so it can be recovered later (with the provision that there is an agreement with the governments of the countries involved); or to seek the maximum dispersion of the fissile material so it will burn up in the atmosphere (there is no risk of radioactive contamination, as the reactor will not have gone critical at that point). This second option, which is less satisfactory environmentally, may be difficult to carry out effectively in certain accidental conditions.

The Reactor After It Goes Critical

The reactor is started only after the planned orbit has been reached. This orbit, called the safety orbit, is designed so that the time of the satellite's natural fall from this orbit to the earth will be long enough to guarantee a decay in the radiation of the fission products until this radiation reaches an acceptable level. This time period--the satellite's natural lifespan--has to be more than 300 years. In general, this is true of circular orbits with an altitude of 600 kilometers.

In a space environment it is essential to keep the radioactivity contained inside the primary circuit (the vessel, ducts, and intermediate exchanger) under all circumstances. As in nuclear reactors used on earth, these parts form the "second barrier" (the "first barrier" is provided by the cladding of the fuel elements). Preliminary evaluations made in the event of power excursions (unwarranted rotation of a control cylinder, for example), of cooling accidents (loss of an electromagnetic pump, jamming of a turboalternator, etc) have shown that the integrity of the cladding was not endangered.

After its shutdown (either at the end of its normal life or a premature end), the reactor will be shifted to a higher altitude orbit so that no return to earth will be possible before approximately 1,000 years. This guarantees a total radiation level of the radioactive source at the time of its return to earth equivalent to that of the mass of the ore used to obtain the initial fissile material.

As the natural lifespan of an orbit increases very rapidly with its altitude, this condition is verified for all space missions not requiring any orbital excursion below an altitude of 800 kilometers. These are the only missions being considered at the present time.

Technical Difficulties Involved in Development of this Reactor

The studies done for the reference model have demonstrated the system's technical feasibility, including its compliance with safety criteria. In the current work phase, other technical options are being examined and may be chosen instead of those presented here. But as it has been described, the ERATO project is a coherent nuclear space generator design which meets the required specifications.

A considerable amount of research and technological development will be required before moving to a specific development program. A determination of the jobs to be done, the definition of programs and an evaluation of the corresponding costs have been given a complete analysis. This study resulted in a development plan with a total duration lasting between 15 and 20 years, depending on the various options selected.

The technological difficulties are primarily related to the high operating temperatures. The materials to be used will have to prove their good behavior in conditions combining mechanical constraints, high temperatures, a corrosive environment, and the effects of irradiation.

The UO_2 fuel, about which a good deal of data is available, may cause some difficult compatibility problems with lithium if the cladding should break. From this point of view, uranium nitride seems to behave well, but it is not so well known. If the nitride option is chosen, a complete fuel qualification program will have to be undertaken (fabrication, characterization, physical-chemical studies, irradiation, etc). Moreover, the fuel's lifespan, 7 years, is much longer than what is attained in a ground-based reactor, and that could give rise to new problems.

The material being considered for the cladding of the fuel elements, which will also be used for the vessel, the primary circuit and the intermediate exchanger, is a molybdenum-rhenium alloy. Some intensive work is needed to bring our knowledge of this material up to a sufficient level, particularly its mechanical properties (creep), its resistance to corrosion, and its behavior under irradiation. The conditions of the preparation and use of this material (cladding, soldering) will also be decisive factors.

The material being considered for the turbine is a tantalum alloy, ASTAR 811C. Its good adaptation to the functions it will have to fulfill still remains to be verified. For parts of the secondary circuit which are not so hot, it should be possible to use Hastelloy X or Inconel X 625.

The selection of other materials will also have to be confirmed after appropriate testing: for example, the beryllium to be used for the main radiator.

Many unconventional components will have to be developed and tested. Without listing all of them, some of the most important and difficult to develop of these components are the following:

a. The lithium-gas intermediate exchanger

b. The high efficiency electromagnetic pumps for lithium

c. Rotating machinery: the turbines, compressors, and alternators will all have to function for 7 years without maintenance.

d. The gas-heat pipes exchangers (evaporators).

In order to treat the problems of operation and safety in an indepth manner, operational tests of the components and subsystems in conditions as close as possible to conditions in space will be required. These tests will be used to analyze the thermal behavior of the system (conduction, radiation), to check

the proper operation of certain subsystems (electromagnetic pumps, turbomachines, etc), to examine some specific problems such as friction in a vacuum at high temperatures (bearing of the control drums) and to check out the performances of the system as a whole.

Although this simulation is not perfect in terms of reproducing the space environment (particularly the zero gravity environment), it is essential to qualify the generator and ensure the success of the mission. So the development and use of a prototype on the ground is an indispensable phase of the project.

Summary

Based on the studies done, the ERATO project appears to be an enterprise entailing some definite technical difficulties, but one whose overall feasibility can not be questioned. This ambitious program will open up access to a new class of space applications with an almost unlimited potential for improved performances. The most ambitious European nations will be able to work with France in this program, finding in it a field for applying their expertise in many high-tech sectors.

So France has good reason to take pride in being the driving force behind this undertaking, which it intends to see through to its completion.

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7679

GORIA EXPLAINS GENERATOR SHIPMENTS TO IRAN

51002406 Rome ANSA in English 0845 GMT 14 Oct 87

[Text] Rome [no date, as received]—Italian Premier Giovanni Goria met for the second time, on Tuesday, with representatives from the Proletarian Democrat Party to discuss the question of Italian-made generators being shipped through a West German firm to Iran, where they will reportedly be used to build two nuclear power plants, a note from the premier's office said here.

After telling the Proletarian Democrat delegation that even Italian head-of-state Francesco Cossiga had expressed his concern over their report, Goria repeated that the generators in question were being sent to the West German "KWU" firm and thus did not require an export licence, unless a specific government directive were to be issued.

Furthermore, Goria explained that the generators in question were of a conventional type not covered by the nuclear nonproliferation pact nor by existing regulations on the partial embargo on goods to Iran and thus no action could be taken to block the shipment unless the United Nations extended the embargo to Iran to include goods other than arms.

On their part, the Proletarian Democrats vowed to continue their struggle to block the shipment of the generators. The Proletarian Democrats have repeatedly recalled that other nations, such as India, have developed nuclear weapons from reactors designed for civilian use and that Iran has every intention of developing an atomic bomb to gain superiority over Iraq in their seven-year conflict.

NUCLEAR POWER PROTOCOL SIGNED WITH ROMANIA

AU031553 Rome ANSA in English 1251 GMT 3 Nov 87

[Text] ANSA] Bucharest, November 3—Ansaldo, a subsidiary of the state IRI-Finmeccanica group, has signed a protocol with Romenergo—the Romanian state agency responsible for commercial relations in carrying out that nation's nuclear power program—to participate in the construction of three nuclear power reactors in Cernavoda, a note from Ansaldo said here. In particular, the accord, signed in Bucharest Monday, relates to reactors 3, 4 and 5 that will produce 600 megawatts of electricity and will be of the Candu-type using heavy water through pressurized tubes.

The three reactors are part of Romania's general nuclear power plan that foresees the construction of several power plants. The first two, reactors one and two, are already under construction by a consortium made up of Ansaldo, General Electric and several Canadian firms.

The Ansaldo communique went on to add that "the accord reinforces Ansaldo's presence on the Romanian market and consolidates Ansaldo's capacity to both cooperate and compete with the major industrial firms in that sector."

In the construction of the first two nuclear reactors, Ansaldo planned and supplied components for nuclear isolation as well as turbogenerators for a value of 184 million dollars. General Electric also supplied turbogenerators while the Canadian firm AECL [Atomic Energy of Canada Limited] supplied the patents and assistance in planning and other Canadian firms nuclear components for nuclear isolation.

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PLANNED NUCLEAR GENERATOR SHIPMENT PROTESTED

Meeting With Cossiga Sought

51002405 Rome ANSA in English 1209 GMT 9 Oct 87

[Text] (ANSA) Rome, October 9—Proletarian Democrat Party secretary Giovanni Russo and the party's lower house whip, Franco Russo, have requested urgent meetings with Italian head-of-state Francesco Cossiga and Prime Minister Giovanni Goria to discuss reports that the [illegible] company Ansaldo, that is partially state-owned, plans to ship nuclear generators to Iran later this month.

The letter from the leftist party called on the government to take "direct action" against the delivery "not only for the obvious reason that these generators are dangerous, but also for more serious considerations."

The Proletarian Democrat Party leaders went on to maintain that it is very probable "today that Iran is once again trying to produce nuclear weapons in hopes of gaining military superiority over Iraq. The supply of the Ansaldo generators is an essential element in this project."

"It has been shown that already in other nations such as India," the letter continued, "atomic weapons were developed through programs for the civil use of nuclear power. We do not want it to be our nation, that claims to intervene in favor of peace, to be responsible for a tremendous escalation in the region."

Yesterday, members of the Proletarian Democrat Party began sit-in demonstrations in front of the Ansaldo plant to prevent the eight generators, to be used in two nuclear power plants, from leaving the premises.

According to Proletarian Democrat Lower House member [illegible], "the generators were ordered by Iran eight years ago through the West German firm KWU. During the [illegible] that accompanied the fall of the Shah, the order was blocked but the components were built just the same."

Cipriani went on to affirm that "at the beginning of September, an Iranian emissary, escorted by Italian police, inspected the generators and gave the go ahead for their delivery".

According to the Proletarian Democrats, while the eight generators themselves were built in the Ansaldo plant of Sesto San Giovanni, near Milan, other components, necessary to build the two 2000 megawatt nuclear power plants, were made by other Italian companies.

Communique Issued on Shipment

AU101421 Rome ANSA in English 1012 GMT 10 Oct 87

[Text] (ANSA) Rome, October 10—The partially state-owned Ansaldo Company is not directly shipping components for nuclear reactors to Iran, according to a communique issued by the prime minister's office here, Friday evening.

The note confirmed that Premier Giovanni Goria had met representatives of the extreme-left Proletaria Democrazia Party during the day, and discussed alleged sales of nuclear components to Iran with them.

Initial enquires by the premier's office revealed that "as things stand (Ansaldo) is not supplying and has no intention of supplying material necessary for the construction of nuclear power stations directly to Iran. The components commissioned from Ansaldo by the West German company KWU [Kraftwerksunion] are the property of that company, and are at present being kept in Ansaldo warehouses on behalf of the West German firm."

Democrazia Proletaria representatives claimed earlier in the day that KWU had ordered the components on behalf of Iran, and said that they were likely to provide that nation with nuclear technology suitable for using in its seven-year old war against Iraq.

Manufacturer Defends Export

AU201203 Rome ANSA in English 1055 GMT 20 Oct 87

[Text] (ANSA) Milan, October 20—The Italian engineering group Ansaldo insisted that eight steam turbines ordered for Iranian nuclear power plants are not components for plants with reactors capable of producing weapons-grade plutonium in a note issued to defuse protest over attempts to deliver the turbines to the West German prime contractor.

The note released Monday by the group in the state-controlled IRI [Institute for Industrial Reconstruction]

holding company came against a backdrop of Italian press accounts on the contract and Premier Giovanni Goria's defense of the Ansaldo sale on the grounds that the turbines were for conventional reactors and not one covered by the nuclear non-proliferation treaty. Demonstrators lead by activists of the proletarian democracy party, however, threw up a cordon around the Milan warehouse where the turbines are in storage and attempted to block shipment.

The Ansaldo note issued Monday said the turbines were ordered in 1976 by KWU [Kraftwerksunion] of West Germany but that the order for the nuclear power plants was subsequently suspended and the cancelled in 1979, following the Islamic revolution which toppled the Shah.

"Since that year, following payment for work completed, the German company has asked Ansaldo to keep the pieces in storage (near Milan) behind regular payment of maintenance and lease expenses," the note said [sentence as received].

Ansaldo went on to cite a finding by the international chamber of commerce in Paris in 1982 which established that "all materials already paid for by Iranians are to be delivered in the condition and at the stage of work in what they are found".

Continuing the chronology of the order, the note said that KWU advised Ansaldo in November 1986 to prepare to deliver the turbines to the German company at the nearest seaport. In September this year, a shipping firm was ordered to transfer the parts to the Marghera port, near Venice, "where they would be delivered to the end-user clients which would have transferred them with their own means.

"Similar procedures have been followed by the other countries (Austria, Germany, etc.) In which other components had been prepared for the same destination," Ansaldo said.

The company noted that the [illegible]e contractor and the sub-contractors were not to [illegible]olved in any way "at the assembly site and in the start-up of the power stations, on which it appears that no work has been begun".

Ansaldo said that half the turbines are not complete and are mere "metallic parts" but that all the work has been paid for and must be made available to the client.

The note also pointed out that the turbines are for pressured water reactors "and therefore not utilizable for the production of plutonium".

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SPOKESMAN DENIES NUCLEAR SALES TO PAKISTAN

51002407 Ankara ANATOLIA in English 1600 GMT 28 Oct 87

[Text] Ankara (A.A.)—Foreign Ministry's Spokesman Inal Batu said today that Turkey fulfills "with great care" her obligations under the agreement preventing the proliferation of nuclear arms.

In a press conference today, Ambassador Inal Batu answered questions about reports that "Turkey will sell Pakistan, material for nuclear arms production and the states will send a follow-up mission for this issue."

Stressing that Turkey diligently fulfills her obligations foreseen by the agreement she signed for preventing nuclear proliferation, Ambassador Batu said that these claims were explicitly denied by himself and Pakistan's Head of State Ziaul Haq who recently visited Turkey.

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